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March Energy Figures Released

40100046a Beijing CEI Database in English 26 Apr 89

[Text] Beijing (CEI)—Following is a chart of China's total output of primary energy production in March 1989, released by CSICSC [China Statistics Information Consultancy Service Center]:

Item	Unit	1-3/89	3/89	Percentage over 1-3/89
Total output (10,000 tons of standard coal)		21564.0	8116.0	108.39
a. Raw coal	10,000 tons	21698.0	8401.0	110.86
including: output under unified central planning	10,000 tons	11104.0	4038.0	103.22
b. Crude oil	10,000 tons	3340.4	1152.9	101.69
c. Natural gas	100 million cubic meters	35.64	12.67	103.34
d. Hydropower	100 million kWh	203.00	74.40	102.48

Energy Ministry Proposes Policies To Ease Energy Crunch

40100047 Beijing XINHUA in English 1200 GMT 2 May 89

[Text] Beijing, 2 May (XINHUA)—The Ministry of Energy Resources has urged the state to adjust the growth rates of industrial and energy production to cope with the energy shortage.

In an interview with CHINA SCIENCE NEWS, a senior official of the ministry said the present energy shortage is a result of poor macro-management and the disproportionate growth of industries.

He said coal production rose by 4.2 percent and [power output] by 9.2 percent last year, but their growth was far below that of industrial production as a whole.

"To ensure sound development of the national economy," he said, "the ratio between the growth rate of industrial production and that of coal production should be 1 to 0.5, and the growth rate of electricity production should be greater than the growth rate of industrial production, or at least the same."

He urged the state to ensure the supply of energy for key industries and key businesses in the face of the present energy shortage.

He said: "To conserve energy resources, businesses that seriously waste energy should be closed and the production of household appliances that consume a lot of energy should be restricted."

The official also urged the state to raise the price of coal and increase investment in coal mining by a big margin so as to boost coal production.

Resolving Energy Shortage Crucial to Further Economic Growth

40130081a Shanghai WORLD ECONOMIC HERALD in Chinese 13 Mar 89 p 14

[Article by WORLD ECONOMIC HERALD Beijing reporter Yang Xiaolin [2799 1420 2651]: "China Must Give Immediate Attention to Energy Growth"]

[Text] In previous economic readjustments, energy resources often became a key factor constricting the scale of investments. In the ongoing administrative reorganizations, electric power continues to be a target for reductions in 1989 national capital construction plan arrangements. Planned investments in coal during 1989 are only 350 million yuan greater than in 1988, which does not compensate for rising prices. Based on the mere 4 percent growth rate in primary energy resources during the first 3 years of the Seventh 5-Year Plan, the national economy can grow by only about 6 percent. Using unattainable energy resource production indices as a foundation for the Eighth and Ninth 5-Year Plans inevitably will create new economic overheating which would engender additional constrictions and readjustments that would cause enormous economic losses.

Sustained reductions in coal output since the beginning of 1989 pose a serious danger to the entire Chinese society and economy. Basic raw materials, iron and steel, and household light industry and textile industry production have declined, and growth in effective social supplies will be obstructed. A rather consistent view of experts in all fields is that of course several unusual measures are urgent for the time being, but it is even more urgent that relevant areas and all social circles deeply understand the necessity of growth in energy resources.

While the main problem with coal in the past few years has been inadequate capacity to ship it out, the problem now is that the bowl is empty. Failure to guarantee mine

production materials caused frequent temporary shutdowns in Shanxi, China's energy province, in the first quarter of 1989. Energy experts feel that after 2 to 3 years of improving coal supplies, a risk of shortages appeared suddenly in June 1988. This is an extremely clear indication that China's energy resource industry is shrinking.

Experts have said in analyzing this that while we have talked for years about focusing on energy resources, the loss of proportion in actual plan arrangements has never been corrected. Investments in energy resources have been seriously inadequate for years and there have been repeated reductions in recent years. Energy investments accounted for 9.2 percent of total investments in fixed assets in society in 1987 and just 8.9 percent in 1988, whereas the usual standard in other countries is 20 percent!

The power shortage led to implementation of several policies to increase inputs in electric power in the later part of the Sixth 5-Year Plan, but inputs for coal dropped due to improving supplies at the time. The rate of growth in coal output during the first 3 years of the Seventh 5-Year Plan was down by 4 percent from the Sixth 5-Year Plan. This reduced the ratio between the growth rates of primary and secondary energy resources from about 0.7 in normal years to 0.33. Thus, with a foundation of a serious loss of proportion between energy-consuming industries and the energy sector, a loss of proportion between coal and electric power also appeared. Simple passive constriction of overheated economic growth to deal with this serious situation is not enough. It is even more important that development of electric power and especially coal be accelerated during the constriction.

Another thing which concerns energy experts, however, is that previous economic readjustments often have made energy resources the main target for restrictions in the scale of investments. This is really strange. During the present administrative reorganization, electric power is still a target for reductions in the scale of capital construction plans throughout China in 1989. Planned investments for coal in 1989 are only 350 million yuan higher than 1988, which cannot compensate for rising prices.

The most serious problem now is that the rate of growth in primary energy resources during the Seventh 5-Year Plan is still too low, and that the state again reduced actual investments implemented in the first 3 years of the Seventh 5-Year Plan. The scale of coal mine construction for direct supply under the jurisdiction of central authorities was reduced by 72.47 million tons, with 15.49 million tons less going into operation. Estimates based on current 1989 plan arrangements indicate that a failure to adopt urgent measures will mean that no coal mines will begin producing in 1993.

Extrapolating from the mere 4 percent growth rate in primary energy resources during the first 3 years of the Seventh 5-Year Plan, the national economy can grow by only about 6 percent. Thus, reducing growth of the overheated economy to 7 to 8 percent still will not solve our serious power and coal shortages. Energy circles in particular have affirmed this. We should again unify our understanding and conscientiously adhere to the principle of energy resource development centered on electric power. The current serious shortages of both power and coal are due to retarded development of the energy sector, and the coal industry in particular has grown too slowly in recent years. They are not the result of overly rapid growth in electric power, and restricting the growth rate of electric power to adapt to the low growth rate of coal would make it impossible to guarantee normal development of the national economy.

Experts also point out that we must begin to increase inputs in 1989 if we are to produce the 1.4 billion tons of coal needed to ensure attainment of our strategic economic development goals by 2000. If unattainable energy production indices are used as a basis for the Eighth and Ninth 5-Year Plans, the inevitable outcome will be a new round of economic overheating, which would again require constriction and readjustment and create even more enormous economic losses.

Again, regarding prices, long-term low energy prices have placed an excessive burden on enterprises which, combined with rising cost factors, has caused them serious losses. This is particularly true of local coal mines, which produce more than one-half of China's coal. They now have a loss of proportion in extraction, serious natural abandonment, and an extremely high death and accident rate. Newly added production capacity at local state-run mines dropped by 1 million tons in the first 3 years of the Seventh 5-Year Plan compared to the Sixth 5-Year Plan, not enough to cover mine output reductions.

Capital raising to build power and establish power construction funds in recent years is an effective method but new contradictions appeared after the state severely reduced investments. The original plan was to supply more than 60 percent of the total national installed generating capacity as power allocated to central authorities, but the actual amount was just 41 percent in 1988 and the projected amount for 1989 is 26 percent, while local processing industries and so on are receiving more power. An irrational investment ratio for electric power has added fuel to the flames of a formerly irrational industrial structure.

To prevent stagnation throughout industrial production due to fluctuating and shrinking coal supplies, we must adopt effective industrial slant policies for investments, materials, and credit to assure growth. This has become a major and unavoidable issue. The state should provide no less than 45 percent of electric power investments. Besides existing collection of a 0.02 yuan/kWh electric

power fund and a 27 yuan/ton petroleum fund for crude oil included in plans, we should begin collecting a coal fund in 1989. Shandong, Fujian, Jiangxi, and other provinces have taken similar steps and they should be implemented throughout China.

Although price readjustments for energy resources face two problems, experts still feel that a suitable increase in prices to gradually form a rational energy price structure is now truly unavoidable. Big users like Shanghai, Guangdong, and others which receive a lot of power feel that a suitable price increase could benefit energy resource exporting provinces and future energy growth would eventually benefit provinces receiving the energy.

One rather consistent view now is that using administrative means to control energy prices makes it very hard to control inflation, and could instead cause the energy sector to wither. A "small steps, no stopping" price readjustment pattern can be used to keep the degree of price increases for energy slightly higher than the inflation rate and to deregulate prices outside of plans and encourage capital raising through multiple channels to build power, coal, oil, and nuclear power and supplement them with other measures. This could aid energy development and reduce the chain reaction of inflation in society.

Overseas Investors Wooed in Effort To Bolster Energy Sector

40130082b Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 25 Mar 89 p 3

[Article by reporter Pan Yanxi [3382 5888 5045]: "Ministry of Energy Resources Official Shi Dazhen Says China Welcomes All Forms of Cooperation With Foreign Countries To Solve China's Energy Shortage"]

[Text] Vice Minister Shi Dazhen [0670 1129 2823] of the Ministry of Energy Resources told reporters that reversing the passive situation of serious energy resource shortages and accelerating development of the energy sector have become key issues for development of China's national economy.

He said that energy resource production in China grew steadily in 1988, with raw coal output of 970 million tons, up 4.5 percent over 1987. Crude oil output was 137 million tons, up 2.2 percent from 1987. Electric power output was 543 billion kWh, up 9.7 percent over 1987. However, China's economy grew more quickly than the rate of growth in the energy sector, resulting in a universal shortage of energy resources, particularly coal and electric power supplies. China's economic development and the people's normal lives have been severely affected.

Vice Minister Shi, who is in charge of the electric power industry, pointed out that China's national economic development plans are to increase primary energy resource output to 1.43 billion tons of standard coal by the year 2000, with power output of 1.2 trillion kWh. The installed generating capacity will increase by 150 million kW during the last 12 years of this century. This will be an average yearly increase of 12 million kW.

Shi Dazhen said in regard to deployment of thermal power construction that the focus will be on developing mining regions and pit mouth power plants, extending joint coal-power management, and a shift from shipping coal to transmitting power. We will build several large coal-power base areas in the lignite region of western northeast China, eastern Heilongjiang, the Tiefa mining region in Liaoning, the region where Shaanxi, Shanxi, and Inner Mongolia adjoin, the Yuxian region in west Beijing, and others. We also will build several thermal power plants along the east coast and along coal transport rail lines, and there will be a major effort to build hydropower and to construct nuclear power stations in a focused and step-by-step manner. We plan to place 50 million kW of hydropower stations into operation before 2000. Besides the Qinshan and Daya Bay nuclear power plants now under construction, we also are preparing to build several nuclear power plants in northeast China, east China, and Guangdong.

Vice Minister Shi Dazhen emphasized that accelerated development of the electric power industry must rely mainly on China. However, China cannot provide hydro, thermal, nuclear, and other power equipment and must import them from foreign countries. China welcomes foreign governments and enterprises to adopt all types of cooperation with China for electric power construction and technical transformation, including loans, supplying equipment and technologies, individual or joint investments to build power plants in China, and so on.

Coal Shortage Worsens in Four Major Power Grids

40130084c Beijing RENMIN RIBAO in Chinese 15 Mar 89 p 1

[Article by reporter Li Anding [2621 1344 1353]: "Substantial Coal Shortages in Four Major Power Grids, Li Peng Holds Meeting To Formulate Countermeasures"]

[Text] There is hope that the electric power shortage now restricting growth of China's national economy can be alleviated. State Council Premier Li Peng convened a meeting on 13 March 1989 to arrange to deal with coal shortages and assure electric power supplies in the four big Northeast China, North China, East China, and Central China power grids.

Premier Li Peng stated at the meeting that we must make a firm decision to increase power output in the second quarter of 1989 throughout China. There is a particular need to focus on increasing power output in these four big power grids and strive to attain levels required in state plans for 1989.

The conference decided to adopt these concrete measures:

1. Preferential economic policies for coal shortages in these four big power grids, with the State Planning Commission and Ministry of Energy Resources being responsible for dividing up implementation in local regions and unified contracting for planning, production, and transportation. Coal supplies in the East China Grid, where the problem is greatest, depend mainly on shipments from Shanxi. Railroads should be repaired more quickly and the water-borne transport capacity should be increased. Coal mines which fail to meet plans for whatever reason should attain production capacity as quickly as possible.

2. These four big power grids should adopt effective measures to assure safe operation, and there is a particular need to focus on safe production in primary power plants. All regions and all departments must take the overall situation into account and strive to ensure power supplies to communications, energy resource, raw materials, and other key enterprises according to the demand for readjustment in economic structures. The State Planning Commission and Ministry of Energy Resources should dispatch electricity use supervision groups for strict supervision of the power use plan implementation in all the grids.

3. The relevant departments should formulate management regulations for electric power dispatching and reinforce legalization and openness in electric power dispatching management to enable supervision by the masses. Forces should be organized to investigate clearly and deal severely with those units and individuals who illegally speculate with coal used for power generation and obtain huge profits.

Officials from the State Planning Commission, Ministry of Energy Resources, Ministry of Railways, Ministry of Communications, Ministry of Materials, and State Price Bureau attended this meeting.

Energy Minister on Growth of Hydropower Sector

40130073a Beijing SHUILI FADIAN [WATER POWER] in Chinese No 1, 12 Jan 89 pp 1-3

[Article: "Rely on Reforms and Policies To Promote Major Development of Hydropower—Minister of Energy Resources Huang Yicheng [7806 3015 6134] Answers SHUILI FADIAN Reporter's Questions"]

[Text] **SHUILI FADIAN:** Energy resources are a strategic focus in development of China's national economy and they concern achievement of the magnificent goal of the four modernizations drive. Could you please outline China's present energy resource situation and prospects as well as the status of hydropower development in our energy strategy.

Huang Yicheng: Overall, China's energy resources at present are characterized by abundant but unevenly distributed resources, high overall energy output but low per capita levels, low utilization rates, high energy consumption per unit of national economic output, and energy consumption dominated by coal. Because the rate of growth in energy resources during the Sixth and Seventh 5-Year Plans was lower than the rate of growth in the national economy, energy resource shortages have begun restricting development of our national economy. Thus, development of energy resource production and energy conservation are urgent tasks for developing China's economy.

China's energy sector has grown substantially since the nation was founded. Primary energy resource output in 1987 was 910 million tons of standard coal. This included raw coal output of 920 million tons, crude oil output of 134 million tons, 13.5 million m^3 of natural gas, and 100.2 billion kWh of hydroelectric power. Total power output converted to secondary energy resources was 497.3 billion kWh, and more than 9 million kW of electric power facilities went into operation in 1987. In China's energy resource structure, however, reserves of the superior energy resources petroleum and natural gas are small and outputs are low. Hydropower resources are abundant but the exploitation rate is just 8 percent. Yearly power output is only 5 percent of developable power output. Coal accounts for 70 percent of energy consumption, with associated problems of shipping and pollution. Primary energy resources grew 3 percent yearly over the past few years and electric power output grew 10 percent annually. The yearly rate of growth in GNP has exceeded 14 percent, however, so there are increasingly severe power and oil shortages. The power shortage in China is now estimated at 70 billion kWh, with economic losses in the hundreds of billions of yuan. Coal shortages also have reappeared. In another area, the thermal efficiency of China's power equipment is low and the added cost of high energy consumption in products means substantial waste of energy resources.

In this type of situation, the basic principles for developing China's energy industry are: With electric power as the focus and coal as the foundation, strive to develop hydropower and nuclear power, actively develop petroleum and natural gas, improve the energy resource production structure, and accelerate construction. With power conservation and oil conservation as the focus, strengthen technical transformation work for energy conservation. We must work to attain yearly primary energy resource output of 1.4 billion tons of standard coal, including 1.4 billion tons of raw coal, 200 million tons of crude oil, 30 billion m^3 of natural gas, a total installed hydropower generating capacity of 80 million kW, yearly power output of 240 billion kWh, nuclear power output of 30 billion kWh, a total national installed generating capacity of 240 million kW, and total yearly power output of 1,200 billion kWh in secondary energy resources to bring per capita energy consumption indices in China up to about 60 percent of the current world average level by the year 2000.

China holds first place worldwide in hydropower resources, with potentially developable hydropower resources of 380 million kW and yearly power output of 1,900 billion kWh, equivalent to 760 million tons of standard coal. If we calculate for hydropower regeneration of 100 years, hydropower resources account for 35 percent of our total energy resources. Thus, from the long-term perspective, hydropower resources are one of China's most important energy resources and should be fully utilized. However, just 30.19 million kW has been developed, with yearly power output of 100.2 billion kWh, equivalent to 40 million tons of standard coal or 4.4 percent of current total energy resource output. this is quite uncoordinated given the amount of resources we have. More development of coal-fired and oil-fired power consumes resources and pollutes the environment, which is extremely unfavorable in the long-term view. Moreover, hydropower generators are easy to start up and shut down, have good dispatching properties, and are suitable for peak regulation or breakdown reserves, making them a superior power source for power grids. For this reason, and beginning with the strategic viewpoint of the energy resource structure, we should develop more hydropower and gradually reverse the situation of insufficient hydropower.

SHUILI FADIAN: Hydropower involves simultaneous development of primary and secondary energy resources. Many comrades advocate giving hydropower the status of primary energy resource development in China and treating it as a primary energy resource for development investments. Please give your views on these questions.

Huang Yicheng: Coal-fired power, oil-fired power, and nuclear power all involve questions of primary extraction, shipping, and conversion to secondary energy resources. Hydropower involves simultaneous development of primary and secondary energy resources, an

advantage held only by hydropower. Traditionally, however, China has included hydropower among electric power projects and treated it as a secondary energy resource. This creates definite distinctions from primary energy resources in plan arrangements, capital utilization, and taxation. To change this traditional view, the relevant economic departments must have a unified understanding. Comrades in the hydropower industry should do some propaganda work in these departments. The Ministry of Energy Resources should meet with relevant departments and strive to provide hydropower with special support policies.

SHUILI FADIAN: In February 1983, leaders in the former Ministry of Water Resources and Electric Power answered a SHUILI FADIAN reporter's question by proposing the strategic goal of "striving to quadruple hydropower's installed generating capacity and power output within 20 years." Please describe actual conditions and prospects for achieving this goal.

Huang Yicheng: From the time that the goal of quadrupling capacity and output in 20 years was proposed in February 1983 until 1987, installed hydropower generating capacity grew by 26 percent and power output rose by 35 percent, equal to annual growth rates of 4.8 and 6.1 percent, respectively, over 5 years. This was less than the respective 7.3 percent and 8.7 percent growth rates in the electric power industry over the same period. If this continues, we will fail to attain the goal of quadrupling capacity and output, and hydropower will decline as a proportion of the electric power industry. Installed hydropower generating capacity as a proportion of total installed generating capacity dropped from 31 percent in 1983 to 29 percent in 1987, and the lack of correspondence between the electric power structure and the resource structure is becoming increasingly acute. Thus, we must adopt many special measures to promote development of hydropower. Ministry of Energy Resources plans for the goal of quadrupling hydropower capacity and output in 20 years are unchanged. Before 2000, we must add 50 million kW in installed generating capacity, start building another 55 million kW, complete feasibility study reports for 100 million kW of large and medium scale hydropower stations, and prepare preliminary designs for 60 million kW. Although reaching this goal will be quite difficult, our determination remains unchanged and we must strive to attain it.

SHUILI FADIAN: What major achievements were made in the areas of reforms and construction in China's hydropower construction at the present time, and what problems exist?

Huang Yicheng: China's first major achievement in recent years in hydropower construction has been to shift from self-managed systems to bid solicitation systems in the construction system. Project supervision and management units have been organized to solicit bids for construction. This has brought in competitive mechanisms and speeded up project construction. Blockage of the flow at the Shitan, Geheyan, and Manwan hydropower stations 1 year ahead of schedule is an achievement of the reforms. Experience in soliciting bids for the Lubuge Hydropower Station and management methods of Japan's (Dacheng) Company have enlightened China's entire construction industry. The hydropower sector should intensify these reforms. The second achievement is higher technical levels in hydropower construction. The Wujiangdu and Longyangxia Hydropower Stations were built under extremely complex geological conditions, and the Gezhouba Hydropower Station was built on the trunk of the Chang Jiang. Construction has now begun at the Erwan Hydropower Station with a 240 meter high dam and an installed generating capacity of 3.3 million kW, among the world's largest. The scale of large and medium scale hydropower stations now under construction is about 24 million kW. Excluding generators already in operation, another 18 million kW will go into operation in the next 5 to 10 years. The largest amount of hydropower capacity placed into operation in a year was 2.03 million kW in 1987. This shows that hydropower construction in China has attained a definite level.

The problems hydropower construction now faces are first, insufficient investments, a too-small scale of construction, and few design reserves, and second, large project investments and long construction schedules. We should use planning management, capital utilization, hydropower sector reforms, and technology to solve these questions.

SHUILI FADIAN: Following the establishment of the Ministry of Energy Resources, what are the plans, deployments, and policies for China's hydropower sector? What measures are involved in intensifying reforms and promoting technical progress?

Huang Yicheng: An important aspect of the state's decision to establish the Ministry of Energy Resources was to accelerate development of the energy sector. The Ministry of Energy Resources has two main tasks: one is to rely on reforms and policies to accelerate energy resource development, and the other is to rely on reforms and policies to raise labor productivity and economic results in the energy sector. After the Ministry of Energy Resources was established, former decentralized management of China's energy resources by many departments was changed to centralized unified management. Hydropower is the superior energy resource among all of them, so we should rely on reforms and policies to promote hydropower development.

The State Council recently approved a reform program for the electric power system. It calls for giving hydropower self-development mechanisms. For a long time, hydropower has developed in a situation of inadequate investments, low prices, and distorted electricity prices. Originally, hydropower was a big money-making enterprise, but our unified financial accounting system created a big common pot for power grids to eat from

with no clear determination of profitable or losing enterprises and which lumped the good together with the bad. Hydropower's advantages never revealed themselves. This created the false impression that hydropower station construction loans could not be repaid. The Ministry of Energy Resources has decided to use reforms to solve this problem. They are preparing to organize hydropower development companies for river basins or provinces. Newly built hydropower stations will practice independent financial accounting and sign economic contracts with power grids. Prices for their power will be determined on the basis of loan repayment requirements and implemented after approval by the relevant departments. Power grids will earn management fees as agents from selling this power. In this way, profits from hydropower are basically returned to hydropower, giving hydropower a capacity for self-development. Price departments in Fujian Province approved an electricity price of 0.154 yuan per kWh for the Shaxikou Hydropower Station, so there should be no problem repaying the loan. Profits after the loan is repaid will go into hydropower, and Fujian's hydropower may develop more quickly. Provinces and grids with rational electricity prices will be those where electric power develops quickest. Recently, several medium-sized hydropower station projects were canceled because electricity prices provided by the grids were too low, which made it hard to raise the money. The price system now created by China's national economy is that one block is central financial income which accounts for about one-third, another block is local financial income, and the third block is enterprise income. Thus, complete reliance on the state is not feasible. We also must motivate and attract money from other areas for power construction, and the price of power in grids should be set on the basis of loan repayment and capital recovery requirements to attract capital. The state now invests over 2 billion yuan yearly in hydropower. Hydropower now generates 100 billion kWh of electricity each year and the entire 0.02 yuan/kWh "electric power construction fund" should be used for hydropower construction. Moreover, an additional 2 billion-plus yuan in foreign investments was raised and used. We should strive in the short term to invest 6 billion yuan annually in hydropower and place 3 million kW into operation each year. After a few years, we should again raise additional capital each year and strive to place 4.5 million kW into operation annually to add 50 million kW in installed generating capacity before 2000. In the area of policies, plans should provide major support for medium and small-scale hydropower construction, simplify application and approval procedures, and expand the scale of investments. Financially, we should remove controls over profits and provide tax reductions or exemptions for hydropower profits if they are reinvested in hydropower. Power grids should remove control over prices, and the price for power supplied to grids should enable hydropower to repay loans. Peak regulation and breakdown reserve power prices also should be implemented. Of course, policy matters affect many state departments, so they are not something the Ministry of Energy Resources can handle alone. Much work is needed to achieve this.

At present, the scale of hydropower construction is not very large. If we fail to start new projects we can place only 13 million kW into operation before 1995, an average of less than 2 million kW each year, far below our goal. Thus, we have had to fight for several medium-scale hydropower projects in the past few years. Medium-scale hydropower involves smaller investments, simpler technologies, and produces results quickly, so it is suited to current needs and to local financial and materials conditions. We are working to formulate several preferential policies to develop medium-scale hydropower and we should focus on promoting technical progress and encouraging adoption of new materials and new technologies, gradually expand the use of rolled concrete and faced stone-fill dams, and study pumped-storage hydropower station construction, generator manufacturing technologies, and so on. The state should focus on construction technologies for high dams and large reservoirs for hydropower stations on major rivers.

SHUILI FADIAN: Finally, with the new year in 1989 coming, please discuss the desires, hopes, and needs of the many employees on China's hydropower battlefront.

Huang Yicheng: In 1989, we should continue work to reform the electric power industry system. I hope that employees on the hydropower battlefront will make new achievements in the two areas of intensifying reforms and raising labor productivity and economic benefits. The forces of production standard should be used to guide and evaluate reforms to aid in good management and utilization of hydropower construction funds.

The Ministry of Energy Resources has decided to focus first of all on shortening construction schedules and making shorter construction schedules the breakthrough point for good capital utilization. Shorter construction schedules naturally would produce better economic benefits. For comrades working in hydropower, just 3 and ½ years were needed to build the main part of the Xin'an Jiang Hydropower Station Project and have the first generator begin producing power. Our level of mechanization is higher now, so why can't this be done? After the change to a bid solicitation system for hydropower construction, there have been benefits in the area of shortening construction schedules. Reforms should continue to be intensified in the construction system, and project monitoring and management systems with Chinese characteristics should be extended. There also should be reforms in the design system, with extension of design commercialization and bid solicitation to encourage competition. Design academies also should work for society and take the road to socialized enterprise development. Only in this way can we solve problems of scientific design, large investments, and long construction schedules. Design reform is an important link in the

reforms as a whole and must keep up with overall system reforms. Construction staffs should increase labor productivity and establish lean and specialized construction staffs to reinforce construction for firstline production staffs. Staffs now bear a heavy burden from too many personnel and enormous organizations. If we fail to simplify structures, staffs cannot "flourish." There also should be fewer cadres. There are no advantages to having too many leading cadres since it can cause buck-passing and contradictions. Organizational optimization in Beijing has many advantages for reducing personnel and improving staff quality, and we should study this point. We must solve distribution problems, manage affairs according to the principle of "more pay for more work," and avoid egalitarianism. Worker incomes should be proportional to their labor, and piece-work wages can be used where situations permit. If we fail to solve this problem it will be impossible to increase benefits. Our design and construction staffs also should develop economic diversification and move into society to be able to build hydropower stations, engage in all types of construction and installation work, enter other industries, and strive to enter international markets and compete internationally.

China's hydropower workforce has an excellent tradition and is capable of a good fight. I believe that in the future this workforce certainly will be able to make even greater contributions to development of China's hydropower sector.

Finally, I would like to offer cordial greetings to the vast numbers of cadres, S&T personnel, and employees who work hard for the cause of hydropower in China and wish them even greater reform and construction achievements in the new year 1989.

Conclusions of Leading Group for Three Gorges Project Released

40130073b Beijing SHUILI FADIAN [WATER POWER] in Chinese No 1, 12 Jan 89 pp 4-8

[Article by Pan Jiazheng [3382 1367 6927], member of the Chinese Academy of Sciences Technical Sciences Department, senior engineer in the Ministry of Energy Resources, and deputy director and chief technical officer in the Three Gorges Project Demonstration Leadership Group: "Conclusions of Ninth (Expanded) Meeting of Three Gorges Project Demonstration Leadership Group Released"]

[Text] The Ninth Meeting (Expanded) of the Three Gorges Project Demonstration Leadership Group which began on 21 November 1988 concluded today after 10 days. The leadership group has asked me to release its conclusions.

Altogether, 206 people attended the meeting, including leadership group members, specially-invited advisers, association directors, 14 expert group consultants, group directors and deputy directors, work group directors, liaison personnel, experts, delegates from relevant units, and comrades from news units. Eight members of the Chinese People's Political Consultative Conference [CPPCC] also were invited to the meeting. This conference discussed two topical reports for an overall plan and water levels and for a comprehensive economic evaluation submitted by two expert groups. These also were the last two of 14 topical demonstration reports. Both reports were comprehensive and demonstrated several major questions of principle, so this meeting was the longest of the expanded leadership group meetings and had the greatest attendance. The opening of the meeting on 21 November was followed by about 3 days spent listening to these two expert group reports and posing questions. The delegates had 27 questions from different perspectives which concerned 10 expert groups, and the respective leaders or experts in these expert groups gave precise and clear replies. A full-session discussion was held from 24 to 26 November, and six members of the CPPCC and a few experts who had not signed the two topical demonstration reports made important speeches. A total of 30 comrades spoke at the full session in an extremely lively fashion. Because of time limitations, arrangements could not be made for seven comrades who had requested to speak, so their remarks were distributed to everyone in written form. Many comrades who participated in the meeting said this type of meeting and discussion fully embodied a democratic and scientific atmosphere and created a very good example, and that the climate of this type of discussion and research, which sought truth from facts and elicited frank and sincere discussion, should be affirmed.

On the basis of speeches to the full session, the leadership group invited special advisers or delegates assigned by their committees and directors of associations to hold a meeting attended by group leaders from the centralized deliberations, comprehensive planning and water levels, comprehensive economic evaluation, silting, waterborne transport, key project construction materials, resettlement, flood prevention, electric power system, and several other expert groups, and delegates of news organizations were invited to participate as observers. There was considerable agreement of views during the centralized discussion. A total of 25 comrades spoke, and absent advisers and members sent delegates or left written remarks. These remarks are extremely important and of great guiding significance for work in future stages. The remarks at the full session will be published together with the meeting. I will now provide a comprehensive summary of the main discussion opinions, and I ask other comrades who attended to fill in and correct any omissions or errors.

I. Review of Demonstration Work

Most comrades affirmed the demonstration work over the past 2 and 1/2-plus years and felt that the decision of the CPC Central Committee and State Council to hold renewed demonstration of the Three Gorges Project was correct. The demonstration was serious, conscientious,

and complete, and the spirit of democracy and science were observed throughout it. Many delegates said the Three Gorges Project demonstration work was unprecedented in China or foreign countries in the amount of work involved, range of research, and extent, and the requirements of the feasibility stage had already been exceeded in many areas. The demonstration clarified many major questions and provided many clear and valuable conclusions which can serve as an important foundation or reference for state policy decisions. The leadership group thanked everyone for their evaluations and for their guidance and support, and, with a certain caution and conscientiousness, everyone will continue working together to complete the final stages of demonstration work.

II. General Views on Two Topical Demonstration Reports

In the centralized deliberations, most comrades agreed with the basic content and conclusions of the two topical demonstration reports.

The Comprehensive Planning and Water Levels Expert Group began with overall deployments in Chang Jiang Basin control and development plans to demonstrate the status and role of the Three Gorges Project. They felt that the special geographic position and enormous scale of the Three Gorges Project gave it undeniable strategic significance and an important role in flood prevention, power generation, and shipping. As for the relationship of the Three Gorges Project to upstream and tributary projects, each has different roles and benefits. They all are parts of controlling and developing the Chang Jiang. They are mutually complementary, not interchangeable, and certainly not mutually exclusive. They should be actively and quickly built on the basis of current local socioeconomic conditions, the need to develop the national economy, and construction conditions of the projects themselves. As for the Three Gorges Project water level program, the comprehensive planning and water level experts summarized the views of all expert groups in recommending a "one-level development, one-time construction, scheduled water storage, and continuous resettlement" program with a dam height of 185 m, an eventual normal water storage level of 175 m, and an initial water storage level of 156 m. Comrades participating in the discussions expressed no views differing in principle from these opinions and conclusions.

The Comprehensive Economic Evaluation Expert Group also demonstrated the strategic significance of the Three Gorges Project in the areas of flood prevention, energy, transportation, and so on, and then intensively analyzed benefits of the Three Gorges Project. Many methods were used to compare various "substitute programs" with the national economic evaluation of the Three Gorges Project and research on the Three Gorges Project, and they did concrete financial and feasibility analysis. Their main conclusion was that the Three Gorges Project is a rare key water conservancy project with enormous comprehensive benefits. The economic results are good, it is financially feasible, and China can bear the load. In summary, the expert groups felt after the comprehensive economic evaluation that among the comparable programs studied, the program of building the Three Gorges Project was better than not building the Three Gorges Project, and that building the Three Gorges Project early would be better than building it later. They suggested that the decision be made soon. Everyone felt that this type of demonstration report was a new exploration and that there were few experiences from the past. Thus, many opinions and questions were raised, particularly regarding China's ability to bear the burden, which was unknown in past project evaluations, so many more views were offered. Nevertheless, many comrades felt that the expert groups did positive work, that analysis by the topical demonstration reports could serve as a foundation for economic and financial evaluation of the feasibility reports, and they agreed with their conclusions.

Based on the opinions from the full-session discussion and centralized deliberations, the leadership group felt that the topical demonstration reports could be approved in principle at this stage and expressed its gratitude to the advisers and specialists in the two expert groups and all comrades who participated directly and indirectly in the work and made contributions. They also hoped that the two expert groups would earnestly consider the various opinions put forth at the full session and discussion session, that some of the data would be checked carefully, and that some not-quite-correct articles would be finalized after suitable revision. All questions raised during the deliberations will be analyzed and dealt with during compilation of the feasibility report.

III. On the Question of Whether or Not To Build the Three Gorges Project and Whether To Build It Soon or Later

During the full session and the centralized deliberations, the delegates vigorously discussed whether or not the Three Gorges Project should be built and whether it should be built soon or later. Everyone spoke out freely, aired their views, and offered opinions from all perspectives. All these opinions helped deepen our knowledge and were of very great enlightening significance for future compilation of feasibility research reports.

To summarize everyone's opinions, with the exception of a very few comrades, there was agreement of opinion on the question of whether or not to build the project. Everyone took the long-term perspective that the Three Gorges Project should be built. The biggest difference of opinion in the discussions centered on the question of whether to build it soon or later. Some delegates felt that given the large scale of the Three Gorges Project and concentrated investments, especially in the first 12 years when there would be only inputs and no output, the state's current economic problems, the capital shortage, inflation, and a rather high rate of increase in materials

prices, and the decision of the 3d Plenum of the 13th CPC Central Committee that the focus in 1989 and 1990 should be on controlling the economic environment, straightening out economic procedures, intensifying reforms, and reducing investments in capital construction, it would be best not to build the Three Gorges Project early under these circumstances to avoid effects on short-term plans or even accelerate inflation and cause instability. Most comrades felt that the Three Gorges Project had major strategic significance and a major relationship with large-scale development after 2000. Full consideration and long-term planning should be used for flood prevention and shipping on the Chang Jiang and for energy resource deployments in central and east China. We cannot merely engage in short-term behavior, and they felt the decision of the 3d Plenum of the 13th CPC Central Committee was a positive measure. The reductions involved buildings, offices, cafeterias, and other non-productive construction, as well as projects with redundant imports, which lacked raw materials and motive power, which had low efficiency and poor quality, and involved substantial waste. This could permit readjustment of the investment structure and reverse the passive situation, which is even more favorable for arrangement of long-term short-line projects with real strategic significance. Moreover, the investments needed for the Three Gorges Project over the years would account for a very small proportion of GNP and total investments in capital construction, and proper arrangements could forestall inflation and materials price increases. Delaying the project would rapidly increase the difficulty and investment involved in resettlement, so they do not advocate delaying construction. Some comrades also offered positive ideas and proposals for patterns of capital raising and feasibility policies, and some comrades hoped that measures would be taken to intensify research on the Three Gorges to produce power sooner.

The leadership group felt that the goal of this renewed demonstration was to compile a realistic feasibility research report. In accordance with capital construction procedures, a feasibility report studies only the technical, economic, and financial feasibility of a project and evaluates its environmental impact to seek truth from facts in evaluating the advantages and disadvantages of building soon or later. It does not decide when construction should begin. The inclusion of a feasibility report in a plan to initiate construction requires decisions for unified consideration and arrangement in national economic plans after state approval.

The leadership group also wanted to clarify that the comprehensive economic evaluation assumed that the "build soon" program would begin construction in 1989 while the "build later" program would start in 2001, to enable concrete comparisons. These were two baseline years used in computations discussed during deliberation and demonstration work by the leadership group in 1986, so they were used for comparison. This was understandable at the time. With the demonstration work lasting 1 year and the present situation, beginning construction in 1989 obviously is not realistic. Thus, a "build soon" program which assumed construction would begin in 1992 was added during compilation of the feasibility report for further analysis to study its effects on the economic evaluation and financial evaluation. Of course, this was only an assumed baseline period for the computations, but it permits further analysis of the advantages and disadvantages of early construction or late construction, and it can provide additional data for state policy decisions.

Some delegates raised the question of using end-of-1986 prices for computations in the evaluation. This method was widely used in most plans given working conditions at that time, and most comrades feel it is acceptable. Given the rather substantial rise in prices in 1988, we should analyze 1988 prices and estimate their effects on construction costs.

The delegates also suggested three funds during the discussions which should be included in the investments: a reservoir region development fund, expenditures for reservoir tail channel renovation, and funds for later resettlement because of silt accumulation. The expert group said this will be explained more clearly in the feasibility report. The delegates will do additional research on methods of raising capital and corresponding policy aspects.

IV. Views on Other Aspects and Analytical Explanations

During the full session, delegates also put forth many views and questions about issues beyond the main points outlined above, and most were answered by leaders of the expert groups or by experts. I will describe them briefly here. Of course, many concrete opinions cannot be summarized completely.

1. The first view concerned anxiety and doubts about basic data for the Three Gorges Project. Examples include reservoir-induced earthquakes, reservoir bank landslips, silt accumulation, reservoir lifespan, civil air defense considerations, and so on. If there are problems with this most basic data, the conditions to build the Three Gorges Project do not exist. These questions did not fall within the range of the two topics at this evaluation, the relevant experts have conducted extensive research and repeated discussion, and they have offered conclusions. After some delegates at the meeting expressed doubts, the leaders of the relevant expert groups or experts in seismic geology, silting, key project construction, and other areas provided additional answers for clarification, proposed scientific foundations, and clarified certain misconceptions. Some experts also provided supplementary documents. We feel that these highly specialized questions should respect and listen to the opinions of the experts and arrive at collective conclusions. The main questions should be considered clarified and resolved. Of course,

certain issues may require more extensive analytical research in the next stage of work, but there are no major problems now which could affect project construction. We hope that comrades who still hold doubts will strengthen their relationships and exchanges with the experts to enable them to understand the situation and come to agreement.

2. The second type of opinion was that certain experts lacked unified understandings of the development pattern for the Three Gorges and the normal water storage level. For example, some experts still believed that the Three Gorges would be developed in a two-level pattern, while other experts began with the perspective of civil air defense or silting and felt that a normal water storage level of 160 m is best. These opinions were continually discussed and studied during the 2-year-long demonstration. After deliberating the overall goal in developing the Three Gorges Project, the maximum comprehensive benefits from the project, and considering all types of real situations, the expert groups finally recommended a program for a water level of 175 m, one-level development, and scheduled water storage. As mentioned previously, most comrades agreed with the conclusions of the expert groups and felt that the recommended water level program could satisfy the minimum requirements of all departments for comprehensive utilization, that it could be accepted by all areas within the limits posed by various restricting factors, that it could serve as a basic program for the feasibility research stage, and that of course further improvements could not be ruled out during the next stage. We welcome experts with different opinions to continue expressing their views, and we will include their speeches or written remarks in the full report for consideration by all cadres in the next stage of work.

3. The third type of opinions concerned different evaluations of the concrete benefits or negative effects of the Three Gorges Project. This is especially true for evaluations of flood prevention and environmental questions. For example, some delegates felt that the Three Gorges would have serious negative effects on the environment, and that the decision should be made carefully. The relevant expert groups have already interpreted these views.

Overall, everyone fully understood and respected the views and concerns of these experts. In the area of flood prevention, the Flood Prevention Expert Group has repeatedly explained that in a river basin as large as the Chang Jiang, the causes and conditions of flood danger on the upper, middle, and lower reaches as well as on the trunk and tributaries are extremely complex, and there is no single measure which can solve all problems. Comprehensive measures for drainage, storage, and flood diversion should be integrated for comprehensive solutions on the basis of local conditions. The Three Gorges Project is a major part of the flood prevention system on the Chang Jiang. It cannot solve all problems, but it has an extremely important and irreplaceable role. Construction of the Three Gorges does not mean in any sense that other measures or other projects can be neglected or abandoned. We have always striven since liberation to build dike protection projects, flood diversion projects, and tributary reservoir construction on the relevant trunk and tributaries, and there is no abandonment of upstream areas to protect downstream areas, waiting for the Three Gorges, or relying only on the Three Gorges. Of course, we feel that it is beneficial for the delegates to put forth these views and that they can increase our vigilance and make us focus on all aspects of flood prevention construction.

On the environmental question, the Environmental Expert Group did a comprehensive demonstration and issued conclusions. The views of the experts differed on some questions in the demonstration, and Professor Yan Kai [0917 1956] recently held a special discussion meeting for extensive discussion which produced more unified opinions. The Three Gorges Project has both positive and negative effects on the environment, and the main negative effects are in the reservoir region. We feel that prerequisite for building the Three Gorges Project should be full attention to environmental issues and taking all necessary active measures for each negative effect to prevent every possible type of damage to the new ecological equilibrium and generate benign cycles in the ecological environment. This is our understanding, and this is the way things have been done. For example, during resettlement arrangements, extremely close attention and emphasis were given to environmental questions, and absolutely no problems with vicious cycles in the environment caused by resettlement arrangements are permitted. Leading comrades from Wanxian, Fuling, and Yichang have made detailed introductions on this point. Moreover, soil conservation work on the upper reaches of the Chang Jiang is now formally underway and will push forward with greater effort and focus in the future.

4. The fourth type of opinion concerned views on substitute programs. Some delegates felt that the Three Gorges Project should be compared with other ideas for developing minerals and hydropower resources in southwest China and solving problems of minority nationalities, meaning that the Three Gorges should not be discussed in terms of the Three Gorges alone. Regarding this question, most delegates felt that when the state undertakes a project, especially a strategic project like that at the Three Gorges, there are naturally other important goals and tasks. If we abandon this starting point in comparing other ideal programs, we cannot proceed. The minerals and energy resources of vast southwest China should be studied and developed, and the living standards of minority nationalities must be improved. This is something entirely different, however, from dealing with flooding on the middle and lower reaches of the Chang Jiang, increasing the shipping capacity on the Chang Jiang, and solving the power use requirements of central and east China. Feasibility

research should be done for each program and submitted to the state for policy decisions, and they do not have a mutually exclusive relationship.

V. Arrangements and Proposals for the Next Step of Work

Based on speeches by delegates at the full session and deliberation meeting and the preceding analysis, the leadership group made the following arrangements and proposals for the next step of work.

1. Ask the two expert groups to study and analyze carefully the questions and views put forth at the full session and deliberation meeting, do the necessary checking and revision of the two reports, and have each provide a final draft and submit a final document.

2. Based on the original deployments in the leadership group, the Chang Jiang Basin Planning Office was made responsible for compiling a feasibility research report on the basis of the demonstration reports from each of the expert groups, and for analyzing and dealing with delegates' views on the comprehensive economic evaluation in the feasibility reports. Because this must be supplemented with specific work, the Comprehensive Economic Evaluation Expert Group was made responsible for guidance and assistance. We hope the other expert groups will provide guidance and assistance according to the requirements of the Chang Jiang Basin Planning Office.

The time period proposed in the report is easy to grasp. The initial arrangement is to hold a 10th (Expanded) Meeting of the Demonstration Leadership Group during the first quarter of 1989 on the same scale as this conference to hold deliberations.

3. The Secretaries Group was charged with collating the discussion opinions in this meeting and full session and the written reports to compile and submit a report to higher authorities as soon as possible. We respect the opinions of a few comrades who asked to speak to the CPC Central Committee and State Council, and will submit them. We must prevent losses or inaccuracy in collating the speeches, and where there are important differences of opinion, the comrades who originally spoke should read them and submit them to the printers.

4. Prior to examination and approval of the feasibility report by the State Council, the expert groups should not disband, but instead should stay together during initial stages of work regardless of when construction of the Three Gorges Project begins. We hope that all experts will offer suggestions. After asking the State Planning Commission for instructions, deployments for the next step can be made when the feasibility report is completed.

5. During the centralized deliberations everyone emphasized that reservoir region construction and trial resettlement points should be integrated with prospects for the Three Gorges Project whenever construction of the Three Gorges Project begins to make forward and backward-looking unified arrangements. We should provide the necessary support and strive to create experiences as quickly as possible, which would benefit China's long-term construction and eliminate poverty and bring prosperity to people in the reservoir region. We hope that the Resettlement Expert Group will offer concrete proposals to the State Council's Three Gorges Region Economic Development Office.

6. The Three Gorges Project Demonstration required research on the overall situation for the Chang Jiang Basin Plan and even China's national economic plans, but it is not a substitute for the Chang Jiang Basin Plan or various local development plans, and even less so can it replace China's national economic plans. Many questions raised in the discussions are quite important but do not fall within the scope of the Three Gorges Project demonstration. Active consideration must be given to them in national plans as well as work by the Ministry of Water Conservancy and Ministry of Energy Resources, regardless of when the Three Gorges is built. They include:

a. Reinforcement of soil conservation work on the upper reaches of the Chang Jiang.

b. Completion of a flood prevention program for the middle and lower reaches as decided in 1980.

c. Focusing on preparatory work for the Jinsha Jiang and key reservoirs and hydropower stations on several tributaries, including Xiluodu and Xiangjiaba, Goupitan and Pengshui on the Wu Jiang, Zipingpu and Hechuan on the Min Jiang, Tingzikou on the Jialing Jiang, Baobugou on the Dadu Jiang, Jinping on the Yalong Jiang, Jiangya and Zaoshi on the Li Jiang, and so on, all of which require active deployments by relevant departments and localities to submit feasibility research reports on a project-by-project basis.

The energy resource supply and demand prospects for Sichuan Province and the central and east China regions are serious, and we propose that relevant departments and localities do macro-level research at the earliest possible date for unified arrangements and solutions.

All the experts, delegates, and expert groups have done a great deal of work for the Three Gorges Project over the past 2 and 1/2-plus years. These two submitted topical demonstration reports were based on 12 previous topical demonstration reports. Another stage has been passed in Three Gorges Project demonstration and the 14 topical demonstration reports and several research articles have congealed the blood of all experts, especially a few deceased comrades. They expended their last breath in the struggle for the Three Gorges Project demonstration

and made the final effort of their lives. We should remember them forever. As the demonstration enters the final stage, we hope that all expert groups and work groups will work together again and continue to focus on completing the tasks set for each project, and that they will fight together to complete the feasibility research report and provide an answer for historical verification of the Three Gorges Project, which has been studied for more than half a century by the Chinese people. We hope that all invited advisers, CPPCC members, people who love society, and comrades in news circles will continue to provide guidance, urging, and assistance. We may have different views on certain questions, but there is one point on which there is complete agreement. It is that our starting point is the maximum benefit for the state and our nationality. We are saddened by the poverty and backwardness still seen in the motherland, and everyone has a strong and urgent desire to invigorate China. There are no material contradictions among us, and this conference intensified understandings and played a very good role in increasing cooperation. We firmly believe that in the future everyone will speak more frankly and sincerely and with full confidence, and that they will unite and cooperate better to eventually reach agreement and begin to work after the State Council makes its decision.

Demonstration of Three Gorges Project Completed

40130084a Shanghai JIEFANG RIBAO in Chinese 8 Mar 89 p 1

[Article by reporter Wu Shishen [0702 1102 3234]: "CPC and Government Concern, Discussion by 400 Experts Concludes Demonstration of Three Gorges Project, Feasibility Report Approved and Submitted to State Council for Selection After Examination"]

[Text] The 10th (Expanded) Meeting of the Three Gorges Project Demonstration Leadership Group approved in principle the "Chang Jiang Three Gorges Key Water Conservancy Project Feasibility Research Report." This concluded a 2 1/2-year appraisal of the Three Gorges Project. Conference directors pointed out that conclusion of the demonstration was not equivalent to a policy decision.

Leadership group officials said the feasibility study report was submitted to the State Council's Three Gorges Project Examination Committee for inspection. After weighing the overall situation, the State Council will decide whether or not to build the world-renowned Three Gorges Project and whether to build it soon or later, and submit its decision to the National People's Congress for examination.

The feasibility study report apparently advocates a construction program of "one-level development, one-time construction, scheduled water storage, and continual resettlement." Some experts had different views on silt accumulation, resettlement, the ecological environment, investment budgets, and other questions. Officials in the demonstration group said that these opinions were submitted along with the feasibility study report to the State Council Three Gorges Project Examination Committee.

The Three Gorges Project has been called China's "magnificent dream." For the past few years, many experts have offered opinions and suggestions from various perspectives. A June 1986 notice issued by the CPC Central Committee and State Council pointed out the need for a positive but extremely cautious attitude toward the Three Gorges Project. It was for this purpose that over 400 experts reopened demonstration work for the Three Gorges Project. While examining 14 topical demonstration reports, the experts' discussions were unusually lively.

Pooling Resources for Major Growth in Hydropower

40130085 Beijing SHUILI FADIAN [WATER POWER] in Chinese No 2, 12 Feb 89 pp 1-3

[Summary of speech by Ministry of Energy Resources chief hydropower engineer Pan Jiazheng [3382 1367 6927], at the National Middle-Aged and Young Hydropower S&T Cadres Academic Report Conference: "Pool the Wisdom and Efforts of Everyone To Make Greater Contributions to Hydropower Development"; first paragraph is SHUILI FADIAN introduction]

[Text] The China Hydroelectric Power Engineering Society held the "National Middle-Aged and Young Hydropower S&T Cadres Academic Report Conference" in Beijing from 19 to 22 November 1988. Chief hydropower engineer Pan Jiazheng of the Ministry of Energy Resources spoke at the meeting. During his speech, he analyzed the present energy situation, introduced a medium-term hydropower development outline plan, pointed out the issues and problems facing hydropower, listed measures and methods to develop hydropower, and called on hydropower system S&T cadres and employees to suggest ways and means to make greater contributions to major hydropower development. His speech is summarized here.

I. The Energy Situation Is Grim, Hydropower Should Make Greater Contributions

What is China's energy situation now? I feel that it is realistic to summarize it with the phrase "great achievements, grim situations, many problems, many difficulties." We must soberly acknowledge this situation and further clarify our principles and tasks.

By the end of 1987, China had produced 920 million tons of raw coal, first place worldwide. Crude oil output was 134 million tons, fifth place worldwide. Natural gas output was 13.5 billion m^3. Our total installed power generating capacity was 100 million kW and power output was 497.3 billion kWh, fourth place worldwide. This included 30 million kW of hydropower installed generating capacity and power output of 100.2 billion

kWh, fourth place in the world. Our nuclear power industry has just begun to grow. Even more substantial growth in our energy sector was expected in 1988. We are truly elated by these achievements, but in per capita terms these are very small figures and we are in the lower ranks of the world. The entire nation has growing shortages of coal, oil, and power. The energy resource shortage is now the main factor restricting development of our national economy and improvement of the people's living standards.

Coal is China's main energy resource, and comrades on the coal battlefront have made enormous contributions to the nation. Still, faster construction of large numbers of big mines and developing large numbers of township and town coal mines faces many problems. Inadequate railway transport capacity also has caused extremely severe problems with coal shipments, and of course there has been no real solution to the problem of environmental pollution from coal. All these things restrict greater development of coal-fired power. In the area of petroleum, China is certainly not rich in petroleum resources and output at our existing oil fields is shrinking. New development will require input of enormous amounts of capital, so the tasks are very arduous and the risks somewhat great. Although we have taken the first steps in the nuclear industry and it will be an important energy resource in the long term, we still must import many key components now which are extremely expensive to manufacture. Thus, the scale of its development will be restricted for the next 10 to 20 years.

Hydropower resources, which are both primary and secondary energy resources, are extremely abundant in China. Besides the 30 million-plus kW already developed, the 18.8 million kW under construction, resources in Tibet and other areas not counted at the present time, and so on, there is at least 200 million kW which could be developed within the next 10 to 20 years. Hydropower is a renewable energy resource which never dries up, requires no fuel or transport, does not pollute the environment, is inexpensive, and also can provide benefits from comprehensive utilization. All these truths are known to everyone. Of course hydropower resources are unevenly distributed and somewhat distant from load centers, but transmitting electricity is always more economical and much more convenient than shipping coal. Developing more hydropower could make greater contributions to energy construction, reduce pressures on the coal and petroleum industries, and reduce pollution. Thus, we should consider the situation, treat urgent state matters with urgency, keep our determination despite the problems we encounter, and fight unwaveringly to move forward. Our 378 million kW of developable hydropower resources and our hydropower workforce which has grown up tested by adversity are our greatest advantages as well as the locus of our hopes and determination. We certainly must make a major effort to develop the motherland's surging rivers and create wealth for our people and future generations. This is our duty as well as our vow!

II. The Goal of Quadrupling Hydropower Is Unchanged, Development Must Be Accelerated

Since the establishment of the Ministry of Energy Resources, an energy development outline plan for 1989 to 2000 has been formulated which proposes that the basic principles for energy resource development in China should be: focus on electric power, coal as the foundation, major efforts to develop hydropower and nuclear power, and active development of petroleum and natural gas. Regarding hydropower, the strategic goal set by the former Ministry of Water Resources and Electric Power of "striving to quadruple hydropower's installed generating capacity and power output within 20 years" remains unchanged, meaning that the installed hydropower generating capacity will reach 80 million kW by the year 2000, with yearly power output of 225 to 250 billion kWh. China's installed hydropower generating capacity is now 30 million-plus kW, with another 18.8 million kW under construction. Thus, over the next 10 years or more we must build an additional 45 million kW in large and medium-scale hydropower stations, place 32 to 36 million kW into operation, and build an additional 14 million kW in small hydropower stations.

Based on these and longer-term goals, the strategic deployment for hydropower development is:

1. We should focus on developing the upper reaches of the Huang He to supply power mainly to northwest China. Focus on developing the Hongshui He and Lancang Jiang to supply power mainly to Yunnan and Guangxi, and transmit power to Guangdong. Focus on developing several key large power stations on the trunk and tributaries of the middle and lower reaches of the Chang Jiang, including the Three Gorges Project, to supply power to central and east China. Completion of cascade power stations on the Jinsha Jiang will achieve the magnificent strategic goal of transmitting power from west to east China. Power stations on the Yalong Jiang, Dadu Jiang, Wu Jiang, and other main tributaries will mainly supply power to Sichuan, Guizhou, and other provinces and autonomous regions and transmit power to east China.

2. We should intensify hydropower development in economically developed regions with energy shortages in east, northeast, central, north, and south China, including expansion, transformation, and exploitation of potential at already-completed power stations, and make a major effort to develop medium and small-scale hydropower. The economic and social benefits of each kWh of power in these regions are extremely obvious, so we definitely cannot be complacent and ignore development because they lack substantial hydropower resources.

3. We should build several high head, large capacity pumped-storage power stations in east China to meet peak and valley demand for power. Guangdong and

Beijing have begun to take the first steps in this area, and other regions should begin studying them immediately and accelerate their development.

4. We should make a major effort to develop medium and small-scale hydropower. China has medium and small-scale hydropower resources throughout its area. These power station projects are simple, have short construction schedules, produce output quickly, and should be given preference in development. This is particularly important in regions with coal shortages. The state will give preferential support to encourage all areas, all departments, and all industries to make joint investments to build and place 14 million kW into operation within the next 12 years.

To attain these goals, we must do good preparatory work and strive to complete feasibility research reports for 100 million kW in large and medium-scale hydropower stations and preliminary design documents for 60 million kW before the year 2000. We certainly must eliminate high construction costs and long construction schedules. In the area of construction costs, we should not plan on price increase factors and try to hold the unit investment per kW to less than 1,500 yuan. Regarding construction schedules, the time involved from the beginning of construction and flow diversion to power generation by the first group of generators is 2 years for small hydropower stations, 3 years for medium-sized hydropower stations, 4 years for large hydropower stations around 500,000 kW, and 5 years for large hydropower stations of about 1 million kW. We believe these goals can be attained with good conscientious preparatory work and guaranteed investments and materials. Funds for preparatory work are seriously inadequate at the present time. To solve this problem, the Ministry of Energy Resources has proposed that a hydropower prospecting fund of 0.002 yuan/kWh be requisitioned from power generated by hydropower. As for funds to build power stations, the Ministry of Energy Resources has estimated that construction investments of about 150 billion yuan will be needed to build an installed hydropower generating capacity of 80 million kW by the end of this century. We believe this enormous sum of capital can be raised through state investments, requisitioning an electric power construction fund, multi-area capital raising, selling power rights, and importing some foreign capital. At the same time, newly built hydropower stations can implement independent accounting after going into operation and use feedback from profits from selling power for hydropower construction. Several hydropower development companies can be organized for river basins and regions to implement support policies that accelerate hydropower development.

III. The Problems We Face

Accelerating hydropower development is essential, but we face many problems in implementing this outline plan. The main ones are:

1. Administrative expenditures, forces, and plan arrangements for preparatory work cannot meet the need for major development of hydropower construction. We hope that the Comprehensive Planning Office of the Ministry of Energy Resources, the Hydropower Development Company, and the Water Conservancy and Hydropower Design Academy will work to formulate concrete plans, projects, schedules, and expenditures as quickly as possible to find problems and shortcomings among them and to suggest methods and opinions to deal with them. They can make special applications for preparatory work funds prior to establishment of the prospecting fund and work to meet urgent requirements. Survey and design work should break down regional concepts and solicit bids or negotiate bids. Some survey and design units in east China should decide to go and work in difficult areas. Some survey and design units in the interior of China should be glad they are going ahead. All survey and design units should unite in cooperation as counterparts in competition and brothers fighting on the same battlefront to join together and make new contributions to developing China's hydropower sector.

2. There is a shortage of construction capital. As long as this problem persists, everything else is just idle talk. The outline plan proposes the idea of raising a 150 billion yuan hydropower construction fund, and we believe that the highest policymaking levels in China, the State Planning Commission, the Ministry of Finance, the Ministry of Energy Resources, and the Energy Resource Investment Company will give it a high degree of attention and gradually implement new methods and measures to raise money for a hydropower construction fund. We also believe that far-sighted provinces, municipalities, and autonomous regions will keep the overall situation and long-term prospects in mind when selecting new methods and new measures.

3. There is the question of the two "hats." Hydropower construction has worn the two hats of large investments and long construction schedules for a long time. Besides failing to ensure investments and materials, we also have many real problems with technical and administrative levels. They can be solved only by relying on S&T progress and intensified reforms in hydropower. Building several new large and medium-sized key power stations in the future will involve increasingly complex natural conditions and growing technical difficulty, so we should be more concerned. If new problems continually appear after we start building a large hydropower station that always require additional investments and successive delays in construction schedules, the state will be unable to bear the burden. Thus, we definitely must grasp key technical problems and continually improve design, construction, and management levels.

4. There is the problem of knowledge. People have always had different views regarding hydropower development. For example, some comrades in the Construction Bank have listed hydropower's so-called shortcomings and view hydropower construction as a major

obstacle to China's energy resource development. Some comrades feel that hydropower construction costs are four times higher than expected, both in China and abroad. While this view is completely baseless, it is quite common. Some comrades consistently feel that hydropower construction produces less power, that guaranteed output capacity is low, that it cannot compete with other energy resources, and that it does not have the capacity for self-development. This debate has gone on for 20 or 30 years. Our attitude is that, regardless of the misconceptions and blame of others, we certainly must seek truth from facts for further deliberation and clarification. At the same time, we should firm up our resolve and work hard to use our accomplishments to give the most persuasive answers.

5. There is the question of coordination among departments, industries, and regions. Hydropower development is an activity which crosses over departmental, regional, industry, and disciplinary lines. It concerns flood prevention, irrigation, resettlement, dealing with inundation, communications, water-borne transport, ecology and the environment, coordination of the economic benefits and interests among regions and departments, and other questions. Thus, we certainly must strengthen cooperation. To do otherwise will restrict the development of hydropower. It deserves special mention here that during readjustment of the various ministerial and commission organs in the State Council and reforms in the construction system, many links are still involved in hydropower construction, and not just in planning, design, project selection, and construction. It also involves increasing numbers of leaders and administrative departments at the central and local levels. Frankly, relationships at the present time are rather intricate, complex, and very hard to coordinate. We are placing our hopes on intensified reforms to straighten them out and simplify them gradually. An even more sincere hope is that comrades in the Ministry of Energy Resources and Ministry of Water Resources will focus on the overall situation in every matter, at all times, and at every location to work together with one heart and go forward hand in hand.

IV. Pool the Wisdom and Efforts of Everyone To Make Greater Contributions to Major Hydropower Development

The goal of major hydropower development is clear, but this makes the road to development more difficult and the tasks more arduous. On the one hand, we place our hopes on intensified and coordinated reforms and on the ability of central authorities to formulate concrete policies to support hydropower. On the other hand, we hope that hydropower employees throughout China, particularly middle-aged and young S&T cadres and older specialists, will suggest ways and means to accelerate hydropower development in China and make real contributions. Examples include helping provincial and autonomous region policymaking departments do research on the issue of energy resource equilibrium, enabling leaders to be concerned with investments to develop hydropower, and selecting good sites for power stations. This is particularly true of the recommendation for constructing a large group of medium-sized hydropower projects. They should go all out to focus on attacks on key S&T problems and develop new theories, new technologies, new structures, new materials, and new techniques, and to use them in all realms to continually optimize designs, conserve the number of projects, reduce project construction costs, and shorten construction schedules, which also includes shortening preparatory work schedules. They also should intensively develop research on hydropower economics, hydropower policies, construction systems, capital raising, self-development, and other topics and write high-level articles and provide them for reference to the relevant departments, and they should do propaganda throughout society. We believe that if everyone works conscientiously, China's hydropower sector will certainly overcome all difficulties and attain even greater development.

Developing Medium-Sized Hydropower Stations

40130073c Beijing SHUILI FADIAN [WATER POWER] in Chinese No 1, 12 Jan 89 pp 9-10

[Article by Li Eding [2621 7725 7844], director of the China Hydroelectric Power Engineering Society: "A Proposal for Actively Promoting Development of Medium-Sized Hydropower Stations"]

[Text] The China Hydroelectric Power Engineering Society organized experts and technical personnel in several 10 units throughout China over the past 2 years in hydropower planning, survey design, scientific research, institutions of higher education, construction, transportation management, and other areas to do a great deal of survey research work, hold several academic symposia, and discuss the "National Technical Economics Policy for Medium-Scale Hydropower Resource Development." It considers accelerated development of medium-sized hydropower to have great strategic and practical significance for invigorating local economies and alleviating the present energy resource and electric power shortages. It calls on the state to formulate rational policies as quickly as possible and to combine key large-scale hydropower stations and small-scale hydropower development with active support and accelerated development and construction of medium-sized hydropower stations.

I. Basic Situation

At the end of 1987, China had an installed hydropower generating capacity of 30.10 million kW, including 11.26 million kW in small hydropower stations under 25,000 kW, equal to 37.4 percent, 6.4 million kW in medium-sized hydropower stations from 25,000 to 250,000 kW,

equal to 21.3 percent, and 12.44 million kW in large hydropower stations over 250,000 kW, equal to 41.3 percent, so the proportion of medium-sized hydropower was low.

Actual data from 69 medium-sized and 25 large hydropower stations built between the 1960's and 1980's and analysis of statistical information on 6 medium-sized and 15 large hydropower stations now under construction shows that medium-sized hydropower stations have a unit investment of 1,300 to 1,800 yuan/kW and a power generation schedule of 3.8 years. Large hydropower stations have a unit investment of 1,100 to 1,500 yuan/kW and a power generation schedule of 7.9 years. The unit investment per kW for medium-sized hydropower stations is about 20 percent higher than for large ones, while the power generation schedule for medium-sized stations is 50 percent shorter than for large ones. The unit investment per kW is now rising for both large and medium-sized hydropower stations, but there is no significant change in their proportions. Appropriate measures also could reduce medium-sized hydropower station construction schedules.

Preliminary surveys now indicate that China could develop over 900 medium-sized hydropower stations with a total installed generating capacity of 67 million kW and yearly power output of 320 billion kWh. Only 100-plus sites or about 6.4 million kW had been developed by the end of 1987, less than 10 percent, so great potential awaits development. Economically-developed and energy-short regions like east, northeast, south-central, and other parts of China have much high quality medium-sized hydropower which could be developed. Thus, we have rich medium-sized hydropower resources and superior technical economics conditions for development.

Medium-sized hydropower stations have an appropriate scale and clear advantages in short construction schedules and providing results quickly. Land preparation and resettlement are easily handled in a decentralized fashion by local areas themselves. The matching power transmission and transforming projects are nearer and more convenient, and they can become a backbone power source in regional power grids. Improvements in operation and dispatching safety and stability also could enable them to become supplementary power sources in large power grids. Some also have benefits in the areas of controlling medium and small river basins and implementing cascade development, with additional benefits from flood prevention, power generation, shipping, irrigation, water supplies, and improving the environment. From the 1950's to 1980's, the Longxi He, Gutian Xi, Yili He, Maotiao He, Yongding He, Hun Jiang, Xi'er He, and other medium-sized river basins were developed in a cascade fashion, and they are providing considerable economic benefits. Cascade development of medium-sized river basins and building medium-sized hydropower stations can be important steps to bring prosperity and invigorate local economies.

Building medium-sized hydropower stations also can open capital-raising channels of many forms and layers. This can help to fully motivate initiative in all regions, all departments, all enterprises, and individuals to pool capital to develop power and make up for inadequate state fund for hydropower construction. In the past few years, urban and rural savings have grown quickly throughout China and the incomes of local township and town enterprises and urban and rural residents have risen. There is much scattered capital in society and hydropower station construction involves fewer investment risks, so it is entirely possible to use funding organizations and many other forms to attract and raise investments for medium-sized hydropower construction from social savings and scattered capital.

Excellent momentum has now appeared in adopting various types of capital raising to build medium-sized hydropower stations. Up to the end of 1987, incomplete statistics show that 14 provinces (and autonomous regions) in China had asked to build 111 medium-sized hydropower stations. Data was more complete for 107 stations with a total installed generating capacity of 4.51 million kW, yearly power output of 19.7 billion kWh, and total investments of 8.8 billion yuan. State plans approved construction of 22 medium-sized hydropower stations in 1986 and 1987 with a total installed generating capacity of 1.03 million kW (averaging 46,800 kW at each station) and total investments of 2 billion yuan. State loans accounted for 560 million yuan, or about one-fourth of the total invested. Anju Hydropower Station in Tongliang County, Sichuan Province, for example, has 30,000 kW in installed generating capacity. The county itself raised 26 million yuan of the 75 million yuan investment. Capital raising savings accounts issued by the county Industrial and Commercial Bank raised 7 million yuan from urban and rural residents. Chongqing City provided a subsidy of 20 million yuan, and central authorities loaned 15 million yuan. Another example is construction of three medium-sized hydropower stations at Fancuo, Longmentan, and Liangqian in Fujian Province, where all the primary capital was invested by provincial, city, and county electric power enterprises and construction enterprises. The units which raised the capital established a board of directors and development company for hydropower station construction and management.

II. Views and Proposals

A. To accelerate development of medium-sized hydropower stations, besides implementing all state policies to encourage capital raising to build electric power, we also propose that the state expand policies which have effectively speeded up small-scale hydropower station construction and apply them in medium-sized hydropower construction.

1. Implement the policy of "self-construction, self-management, self-utilization" and "profits to those who invest in and use electric power," adhere to the 20-character principle to "separate government authority

from enterprise management, with provinces as the substance, integrate power grids, unify dispatching, and raise capital to build power," transfer authority to local areas for development, establish management committees or boards of directors from areas or units which raise capital or develop companies for management, use contracts to allocate power use rights for all electric power, and strive to meet local demand.

2. Taxation policy. For a certain period after a power station begins operating, duplicate the treatment for small-scale hydropower, lower the product tax to 5 percent, implement pre-tax loan repayment, and provide exemptions from energy resource, communications, urban construction, and land use taxes for the period of loan repayment.

3. Adhere to the principle of "using power to develop power." Excluding compensation for investments, all remaining profits from power generation should be used to build medium-sized hydropower stations and gradually expand capital for medium-sized hydropower construction.

4. For electricity price policies, implement the "Temporary Decision on Multiple Electricity Prices To Encourage Capital Raising for Power Development" and set electricity prices for power sold by stations themselves and transmitted to grids according to the principle of repaying the principal and interest and a region's capacity to bear the burden.

5. Investment policy. Medium-sized hydropower stations mainly emphasize local capital raising for construction, but development would be quicker if the state could provide some support as a stimulant and coagulant to motivate local initiative. I propose that the special fund support policy for medium-sized hydropower in the Seventh 5-Year Plan be reinstated. In situations where foreign capital can be used, I propose that the national or local governments stipulate requisition of some foreign exchange from export products which use power, that the government facilitate using foreign investments to settle accounts, or that it permit conversion first into internal capital for utilization and then convert the income into foreign investments for repayment.

6. Credit policy. We hope to provide preferential treatment for interest on credit, and we can start with medium-sized hydropower under 100,000 kW.

7. Investment sharing policy. For medium-sized hydropower with comprehensive utilization benefits, implement investment by beneficiary departments and operational expense sharing.

B. To accelerate development of medium-sized hydropower, we should reinforce preparatory work to enable selective development and prevent bad investments. I propose that local planning and finance departments provide the needed preparatory work expenses from electric power construction capital used for medium-sized hydropower.

C. In the area of strengthening organizational leadership, I propose that the Ministry of Energy Resources and Ministry of Water Conservancy appoint a special department to manage work to develop medium-sized hydropower and formulate policies for unified planning. The State Energy Resource Investment Company should organize a medium-sized hydropower station company to manage state support capital and promote construction. Local governments, banks, and administrative departments can organize a medium-sized hydropower funding commission to be responsible for unified construction and management. Provinces with considerable medium-sized hydropower resources can establish medium-sized hydropower development companies and organize economic bodies.

We feel that present large-scale power stations and large power grids cannot provide all the power needed in all regions in a temporal and spatial sense, especially given the flourishing development of township, town, and village economies. When reliance solely on small-scale hydropower cannot satisfy demand, it is essential that we focus on the economically reliable method of building several medium-sized hydropower stations. This is of great strategic significance for improving regional energy resource structures, invigorating regional economies, and improving the people's material and cultural living standards, and it has great real significance for alleviating the present energy resource and electric power shortages and for accomplishing the task of quadrupling electric power output by the year 2000.

We estimate that implementation of these proposed policies will substantially promote local initiative for electric power construction and quickly raise a high tide of medium-sized hydropower construction. It is entirely possible to place 1 million kW in installed generating capacity into operation each year in China in the future, to increase the installed generating capacity in medium-sized hydropower to 10 million kW by the year 2000, and to add another 15 to 20 million kW between 2000 and 2015.

Small-Scale Hydropower: Twice the Output With Half the Investment

40130082a Shanghai JIEFANG RIBAO in Chinese 18 Mar 89 p 3

[Article by Yang Jike [2799 4764 3784], member of the National People's Congress, vice chairman of the China Zhi Gong Dang Central Committee Standing Committee, and deputy director of the China Energy Research Society: "Building Hydropower: Twice the Results With Half the Effort"; first paragraph is JIEFANG RIBAO introduction]

[Text] Yang Jike, member of the National People's Congress, vice chairman of the China Zhi Gong Dang Central Committee Standing Committee, and deputy director of the China Energy Research Society, is a famous Chinese scholar. He is currently on a business

trip to Shanghai. JIEFANG RIBAO made a special request to him to write this very insightful article. We hope that publication of this piece will attract attention from all areas.

China is the world's richest nation in hydropower resources and we have spoken of "priority to hydropower development" for more than 30 years. Every energy resource and electric power research report proposes "active acceleration of hydropower construction, steady growth in the proportion of hydropower," but hydropower as a proportion of electric power construction actually has declined. For the past few years, many enthusiastic people, both bureaucrats and civilians, have frequently expended their efforts in large-scale debate. I feel that with the increasingly severe electric power shortage now and in the future, the time truly has come to abandon prejudices and evaluate national strengths in selecting hydropower construction programs with the best economic results possible from many feasible programs, replacing discussions of principles with handling concrete matters related to work, and changing confusion and dissension into cooperation.

There is a program which may have superior economic and social results compared to others. It is planned and step-by-step development of 14 million kW of hydropower resources in old revolutionary base areas and mountainous regions in the seven provinces of Jiangsi, Hunan, Guangdong, Fujian, Zhejiang, Hainan, and Anhui.

Over the next 10 years, there are at least 10 advantages to building hydropower stations with a total installed generating capacity of 14 million kW in these seven provinces of southeast China compared to building large-scale hydropower stations in west China and they must be described.

1. China has the financial resources, and it could help motivate initiative for local investment in energy.

It costs tens of billions of yuan to build a huge 10 million kW grade hydropower station and the capital must come from central finances alone. This is an enormously heavy burden, and there are only inputs and no outputs for 10 to 20 years. Substituting 2,000 small-scale hydropower stations averaging 5,000 kW each, however, would still provide 10 million kW in total installed generating capacity, but the cost could be borne by both the central and local levels, with central finances providing at most one-third of the total investment. In the former case there is concern that it alone cannot save the situation, whereas in the latter case there is the advantage of "many hands making light work."

2. Unemployed personnel would have job opportunities to solve the surplus social labor power problem.

Over 30 million surplus laborers in China's rural areas have been working at contract or temporary jobs and entering the urban construction workforce in recent years. Several cities recently stopped building many buildings and offices, and these workers have been forced to find work elsewhere. This has put substantial social pressures on provinces, municipalities, and autonomous regions which originally brought in this labor power. Building several small reservoirs and small hydropower stations would give them jobs, and small-scale hydropower energy resource construction would have major benefits for economic development.

3. Repeated population resettlement and the "tragedy" of hardships in making a living for people resettled from flooded areas could be avoided.

When China builds a hydropower station, we must be concerned with resettling the population in the region to be inundated. The larger the area to be flooded, the bigger the resettlement problem. The five big reservoirs in Anhui Province's Dabie Shan region were completed 30 years ago, but the state still provides substantial poverty relief for 200,000 people resettled from the flooded region. The situation is similar in other provinces of southeast China. We cannot build large hydropower stations without taking the livelihood of a large resettled population into account to create "old debts not repaid, new debts added." Building small reservoirs and small hydropower stations would eliminate problems of repeated resettlement.

4. Small hydropower stations have short construction schedules and provide benefits quickly.

After spending 2 years and 8 months simply debating the status and role of a huge reservoir and hydropower project, an engineering program, technical feasibility, reservoir flooding and resettlement arrangements, environmental impact evaluations, investment estimations, comprehensive economic evaluations, and other things, it will take another 20 years to actually complete the project. In contrast, building a small-scale hydropower station takes less than 2 years from beginning to end and it can begin operating in 3 years at the most. The small-scale hydropower projects with a total installed generating capacity of 14 million kW in mountainous areas of the seven provinces described above could be built in 20 years with rational planning to build them in groups. The government could allow electricity prices to float via market regulation for the electricity generated by these power stations built in groups, and the central Ministry of Finance could provide 1 billion yuan annually or the first 5 years to assist local areas in getting started and then use power to develop power, so they would not have to worry about being unable to develop it themselves. It is easily calculated that during a similar 10-year period, a huge hydropower station would still be under construction but small-scale hydropower would already be playing a role.

5. Construction expenses for long-distance ultrahigh voltage power transmission and transformation circuits would be saved and electric power losses reduced.

China's energy resource and industrial deployment system is characterized by regions which supply energy being located mainly in the west while industries needing the energy are located mainly in the east, forcing us to transport northern coal to the south and transmit western power to the east. In the long term, it may be quite rational to use west China's rich energy resources to build base areas for heavy industry and high energy-consuming industries in west China in the next 50 years, but actually the amount of power transmitted eastward can only increase, not decrease. For example, it cost a total of 1 billion yuan to build a 500 kV ultrahigh voltage power transmission line from Gezhouba Hydropower Station to Shanghai, and the economic benefits still must be audited. Power interruptions in the first half-section may result in low utilization efficiency in the last half-section. It would seem that both sides would benefit from transmission of western power to the east only when there is a surplus of power beyond that consumed by west China itself. Otherwise, many contradictions and interruptions will be hard to avoid. Thus, it is reasonable to conjecture that it would not be best to build ultrahigh voltage transmission circuits to transmit power from west to east China during this century. An alternative would be building more small hydropower stations in mountainous areas of southeastern provinces. This would save a currently uneconomical investment.

6. Natural resources of mountainous regions should be shipped out after processing to bring prosperity to mountain people.

Production is backward and the masses are poor in the mountains of China's seven southeastern provinces. People are living below the poverty line. Mountain people want to overcome poverty and become prosperous. Mountain regions' abundant resources can bring prosperity. The road to prosperity for mountain people, however, lies in a gradual shift from their current manual processing of their rich resources to semi-manual and semi-electrified processing. Electric power must move ahead first to achieve this. Most of these mountainous regions produce no coal, so their only way out is to exploit all developable small-scale hydropower.

7. Semi-manual and semi-electrified processing industries below the county level can absorb large amounts of surplus labor locally.

China will have 70 million laborers entering the labor market in this century and another 110 million adult laborers will move from agriculture to industry and commerce. This big labor army absolutely cannot be absorbed by cities and state-run enterprises. The solution is to create conditions to enable them to leave the soil without leaving their villages and maintain local job opportunities for them. For southern China's mountainous regions, above-ground and underground resources should be effectively protected and utilized to increase employment opportunities. Electric power could bring prosperity to mountain people. Prosperity would enable them to leave the soil without leaving their villages and live in peace and contentment in mountainous areas.

8. Farmland drought resistance and the capacity to drain waterlogged land would improve, which would also benefit restoration and maintenance of the ecological equilibrium.

Mountainous regions are full of gullies and ravines and have great differences in elevation that result in frequent flooding and drought with serious harm to the people. Reservoir and small-scale hydropower construction should be combined with comprehensive planning and multi-goal development to effectively improve the drought resistance of farmland and capacity to drain waterlogged land. Firewood is the primary household energy source of peasants in mountainous regions, which causes ecological destruction and severe water loss and soil erosion. Some peasants in regions where more small-scale hydropower has been developed can use surplus electric power and power during non-irrigation periods for cooking, which would aid in protecting forests and vegetation.

9. It would aid exports of labor and equipment for hydropower prospecting, design, installation, debugging, and so on.

Most mountain counties have specialized technical personnel engaged in prospecting, planning, design, construction, operation, and management. Some provinces and autonomous regions also have taken on small-scale hydropower construction tasks in foreign countries. There is a rather complete set of principles, policies, regulations, and standards for small-scale hydropower design, construction, production, management, and other areas. There also is a complete set of examination and approval procedures for power plants larger than 500 kW and for 35 kV power transmission and transforming projects. Equipment manufacturing has now grown to 83 product types in 36 series and expanded from importing equipment to exporting equipment. China has nearly 100 manufacturing plants with an annual production capacity of more than 1 million kW. We can build our own small hydropower stations for heads of 2 to 400 m with single unit capacities ranging from a few 100 to 10,000 kW, and some have attained international levels. There is great potential and very good prospects for labor and equipment exports for small-scale hydropower prospecting, design, installation, debugging, and other areas. If the state gives attention to small-scale hydropower development in mountainous areas of southeast China to make further improvements in these five areas and creates excellent environmental conditions, there would be big prospects for developing foreign trade exports in this industry.

10. Start implementing the "three selfs," explore new reforms in energy resource and economic systems.

Mountain people benefit little when the state builds medium-scale hydropower stations. The peasants must provide their own bedding, rations, and tools to build a power station, but their villages cannot use its power. Premier Li Peng proposed the "three selfs" principle of "self-construction, self-management, self-utilization" for small-scale hydropower construction, and it is very correct. The old system now in effect, however, has many defects. Reforming it will not be easy, but we must reform it. Beginning with the "three selfs" in small-scale hydropower would seem to be feasible, and it could open new ways to reform the electric power management system.

The rate of growth in energy resources and electric power construction in the United States, Japan, the Soviet Union, and other nations has exceeded the rate of growth in industrial construction by more than 20 percent, whereas the average rate of growth in energy resources and electric power in China since 1984 has been only 60 percent the rate of growth in industry. Using more energy than we produce is the main cause of the universal power shortage in urban and rural areas in China. Energy resources have been treated as a strategic focus in China for several years now. Why does the situation of hot industry and cold energy persist? It is perhaps because everyone spends their efforts debating big and far-off projects while ignoring comparative research on electric power construction strategies and systems that has caused policymakers to vacillate. I hope this type of comparative research on hydropower construction strategies and systems for China's seven southeastern provinces will end these arguments and lead to cooperation for progress.

Real Strides Being Made in Supercritical Generator Work

40130081b Shanghai JIEFANG RIBAO in Chinese 17 Mar 89 p 6

[Article by Wang Su [3769 4790], vice chairman of the Shanghai Supercritical Power Plant Leadership Group: "Supercritical Generators: A New Peak in China's Power Plant Equipment Manufacturing"]

[Text] Supercritical generators represent a high level in modern power generation equipment. They are a synthesis of development levels in the electromechanical, metallurgical, instrument, computer, chemical, and other industries. The world's industrially developed nations have been manufacturing them since the late 1950's and have installed over 500 supercritical generators. The use of large numbers of supercritical generators and heat-power cogeneration in Japan and the Soviet Union has reduced the amount of coal consumed per kWh to 337.7 grams and 328 grams, respectively. The amount of coal consumed by China's thermal power is 100 grams higher than Japan and the Soviet Union. In 1988 alone, the use of low thermal efficiency thermal power generators consumed an additional 40 million tons of coal. Thus, raising the thermal efficiency of generators demands immediate attention.

The first practical gas turbine generator was made in 1883. For more than 100 years gas turbine generator power plants have spread throughout the world and are now the primary power generating equipment. One basic regularity can be seen in summarizing the development of thermal generator technologies over the past 100-plus years. It is that every major advance began with increased generator thermal efficiency and breakthroughs which then promoted improvements in other technical economics indices.

The main routes to increased generator thermal efficiency are larger unit capacity, higher steam parameters, and optimal thermodynamic systems. Supercritical generators continue to be the primary way to increase generator thermal efficiency.

After long-term deliberation and repeated research, China decided to build two 600,000 kW supercritical generators at advanced 1980's world levels at Shanghai's Shidongkou No 2 Plant. With approval by the State Council, equipment as well as the necessary design and manufacturing technologies were imported, and we asked that some tasks be counter-contracted within China to save foreign exchange and improve China's power generation power manufacturing levels.

The equipment counter-contracting work indicates that Shanghai has now begun to design and manufacture 600,000 kW supercritical generator equipment. Work during the first stage has permitted a preliminary exploration within an extremely short manufacturing schedule of large-scale international technical cooperation, ways to unify Chinese and international standards, and ways to exchange information quickly and carry out technical relationships so that the work proceeds in synchronization with foreign companies to overcome many problems in technical management and organizational work, and to prepare and train personnel to enable Chinese power plant equipment to enter world markets. It also has promoted technical improvements and breakthroughs at the contracting manufacturing plants.

In May 1988, supercritical generator development was included among Shanghai's 14 key industrial and technical breakthrough projects, placing work to develop supercritical generators into the channel of key development. Relevant departments indicate that we have organized eight institutions of higher education and scientific research units to participate in technical importing, proposing key technical topics, conducting project evaluations and examinations, organizing imported technology exchanges, implementing main unit program design, and attacking key systems scientific research topics. This and other work has led to real implementation of supercritical generator development work.

Haikou Power Plant Adds Another Generator

40130079a Beijing ZHONGGUO JIDIAN BAO in Chinese 2 Mar 89 p 1

[Article by Zhang Zhongyuan [1728 6850 6678]: "No 2 Generator at Haikou Power Plant Begins Operating Ahead of Schedule, Enterprise Group Responsible for Building Power Plant Proclaims Another Victory"]

[Excerpt] Electric power leads the way on a spring morning on Hainan. On 27 January 1989, after a 24-hour run-up, the No 2 generator at the Haikou Power Plant, which was contracted to the Dongfang [East] Power Plant Equipment Unit Company, was formally placed on-line. With this, the first power plant project contracted entirely to an enterprise group in China announced victory.

To solve China's electric power shortage quickly with the smallest possible investments and improve local capital raising to develop power, Hainan Province invited bids for full contractual responsibility over construction of two 50,000 kW generators at the Haikou Power Plant. The Dongfang Power Plant Equipment Unit Company used its advantages in equipment manufacturing, equipment units, and other areas to lead the way in joining with the Guizhou No 1 Electric Power Construction Company and Guangdong Province No 3 Construction Company to win victory in competition with 11 bidders, signing a full responsibility contract on 13 June 1986. Besides dealing with capital shortages, this project also had to cope with shipping equipment by sea, powerful typhoons, and other problems not encountered in power plant construction in the interior of China.

Thus, the Dongfang Equipment Unit Company began with the most difficult parts, struggled to push forward, and gave it their best try. With the concern of the Ministry of Energy Resources, Ministry of Machine Building and Electronics, and Hainan Province and support from the relevant units, they completed their total contractual responsibility 2 and ½ months ahead of schedule and provided an initial glimpse of the broad prospects of enterprise groups contracting for power plants. The responsible person on the user side, Hainan Province Electric Power Company manager Wang Shoushen [3769 1343 6500] said in evaluating this matter: "Even under the special conditions found on Hainan, it took just 25 months for completion and startup, a pace seldom seen either in China or foreign countries." [passage omitted]

Where Is the Reserve Strength of the Coal Industry?

40130079b Beijing RENMIN RIBAO in Chinese
5 Mar 89 p 5

[Article by RENMIN RIBAO reporter Liu Xieyang [0491 3610 7122]]

[Text] Without coal, how can there be electric power? Without coal, no other industries can survive. Once more, we have another coal shortage and seriously inadequate reserve strength. There are problems with investment policy, price policy, and mine workforces. The solution is opening all channels to foster initiative everywhere to open mines, transforming and exploiting potential to increase productive potential in existing mines, focusing on the coal price question and gradually straightening it out, and increasing our concern for mine workers a hundred-fold.

Temporary improvements in the coal shortage for the past 3 years began to change in 1988, and China's social reserves of coal are gradually shrinking. This is particularly true in east China, northeast China, Guangdong and Guangxi, Hunan and Hubei, and other coal-short regions where several emergencies have been declared.

The relevant departments predict that, instead of improving within a rather long period into the future, the shortages will become more acute. Arrangements in the Seventh 5-Year Plan set coal output in China in 1990 at 1 billion tons, which is 130 million tons more than actual output in 1985 and an average yearly increase of 26 million tons. However, demand for coal for electric power, the railway industry, and household use will rise by 37.6 million tons, producing an annual shortage of 11.6 million tons. When we add coal used in other industries, the total coal shortage in the Seventh 5-Year Plan will approach 70 million tons. If the gross value of industrial and agricultural output rises by 6 percent yearly up to the end of this century as planned, minimum energy resource demand will be 1.47 billion tons of standard coal, so the shortage will become even more acute. Inadequate reserve strength in the coal industry will seriously affect development of the national economy.

An important way to solve the energy shortage is to increase inputs needed in the coal industry. Temporary improvement in the coal shortage for the past 2 years made some comrades think the coal problem was solved. This was a mistake. Construction schedules for coal mines are rather long, usually taking about 10 years from groundbreaking until the start of operation at large and medium scale mines. Without immediate investments in coal mines, it will be impossible to get coal when we need it. Although the state has provided some inputs to the coal industry in the past few years, the investments are much too small, far less than those in the electric power industry. Without coal, where will the power come from? A total of 31.5 billion yuan was invested in unified distribution coal mines during the Seventh 5-Year Plan. Arrangements were to invest 25.2 billion yuan during the first 4 years, but 23.5 billion yuan were actually invested, so investments were 1.7 billion yuan less than planned. With reduced investments, construction began on only 49.92 million tons of mine capacity in the first 4 years, a reduction of 83.8 million tons under construction. Projections for the first 4 years were that 89.91 million tons in mine capacity would go into operation, a reduction of 42.21 million tons. This will have extremely serious effects on future coal production.

We should open up all types of channels to provide the investments needed for coal because we cannot rely on central finances alone. We must make full use of local initiative to run coal mines, and we should make good use of foreign capital to develop coal mines. We must stop relying completely on financial administrations and allowing investments to fluctuate according to fund availability in raising money to build coal mines. The principle should be that anyone who uses coal should provide money to mine coal.

Rational resource utilization and exploitation of production potential at existing mines are the keys to increased coal output. It should be acknowledged that some of China's key coal mines have faced excessive loads and inadequate investments for quite a long time. Some older mines have outlived their useful lives and been abandoned. Projections are that 43 million tons in mine capacity will have to be scrapped at unified distribution coal mines before 2000, and output at old mines will drop by 30 million tons, so the total output reduction due to age and abandonment will exceed 70 million tons. In this type of situation, is coal production powerless? The answer is no. One merely has to examine the situation in coal mine work in China to see the problem. The degree of mechanization is just 30-plus percent at China's unified distribution coal mines and only about 15 percent at local coal mines now, which means that most of the 1 billion tons of coal must be extracted manually. Efficiency is low and full efficiency cannot be achieved on work faces where mechanization has been used. Tens of millions of tons of additional coal could be produced in 1 year by exploiting the efficacy of mechanization, increasing unit output of work faces and shafts, raising efficiency, and increasing recovery rates. Thus, in the future we must use capital rationally, select several coal mines with rich reserves and better extraction conditions, reinforce management and raise mechanization rates for expansion and technical transformation, exploit potential, increase output with fewer inputs, and compensate for aging mines.

The coal price question is the most sensitive issue as well as the main problem affecting coal production. If it is not solved and the coal industry lacks a "transfusion" mechanism, how can it have reserve strength? Data from a national industrial survey indicate that the state invested a total of more than 75.89 billion yuan in the coal industry between 1949 and 1985, but profits and taxes

recovered over the same period were just 29.6 percent of the amount invested. This was far lower than the average recovery rate for all industry (207.18 percent) and lower than the average recovery rate for extractive industries (91.13 percent). Although investments in capital construction were renamed loans in recent years, they actually are uncompensated inputs because coal mines basically do not have the capacity to pay interest. The state also has to set aside a substantial sum of money each year to compensate for losses at coal mines. In 1987, for example, the state had to allocate over 7 billion yuan in capital (5.81 billion yuan in investments, 1.449 billion yuan in loss subsidies) in a single year. Actually, low-priced coal supplied by coal mines is a hidden subsidy to coal-using units and localities. Industries and localities which use coal are unwilling to invest their money in building coal mines in this sort of situation. Provincial and autonomous region investments in coal mines [averaged] 959 million yuan during the past few years, but fell to 715 million yuan in 1986 and 766 million yuan in 1987. If we deduct price increases for raw materials used in construction, the actual extent of the decrease would be even greater.

Sales of coal at prices which are too low cannot compensate coal mines for coal mine production costs, so they have had to rely on state subsidies for many years. With the added problems of state finances, there has been insufficient "transfusion" to coal mines, placing them in difficult straits for a long time. During the 30-year period between 1959 and 1988, there were 11 years in which the entire unified distribution coal mine industry operated at a loss and 19 years in which more than 50 percent of enterprises operated at a loss. Losses in 1987 reached 72.8 percent and losses in local state-run coal mine enterprises reached 53 percent. Coal concerns every industry and every household, and the price of coal is a very sensitive question. Solving this problem takes time and a process, but we cannot avoid it. We must gradually straighten out coal prices before healthy development of the coal industry is possible.

Stability in mine workforces and hundred-fold concern for miners' lives are indispensable and important guarantees for increasing reserve strength in the coal industry. Working conditions in the coal industry are difficult and dangerous. Miners' wages in foreign countries are usually higher than other industries. For the past 20 to 30 years, average wages in China's coal industry led all other industries. This changed in the past few years, dropping from 4th place in 1984 to 14th place in 1985. Wage readjustments in 1986 raised them back to 3d place, but because the entire industry operated at a loss, workers were not paid the wages they should have received. The average wage dropped again to 11th place nationwide in 1987. How can coal mine workforces be stabilized in this situation?

Only 12 years remain between now and the year 2000. If we fail to make good arrangements and show concern for reserve strengths for coal production, a major energy resource, we will not have enough time to grasp it later.

Sichuan's Higher Output Still Cannot Satisfy Demand

40130084b Chengdu SICHUAN RIBAO in Chinese 6 Feb 89 p 1

[Article by SICHUAN RIBAO reporter Su Songqiao [0124 2646 0829]: "Another Increase in Coal Output in Sichuan Province in 1988, Supplies Still Cannot Satisfy Excessive Demand"]

[Text] How are things now with coal, which accounts for 74 percent of Sichuan's energy resource consumption structure? The Sichuan Coal Industry Work Conference indicated not long ago that Sichuan produced 66.58 million tons of raw coal in 1988, which was 12.58 million tons over plan and up by 8.57 percent over 1987. The rate of growth was double the national average. Plan quotas were exceeded in all "blocks," including unified distribution mines, province-run mines, and prefecture, county, township, and town mines.

There has been sustained and stable growth in Sichuan's coal industry for the past decade. In the last half of 1988, however, coal shortages started appearing. Prefecture and city coal supplies were critical and some users urged declaration of coal emergencies. As officials from the Sichuan Province Coal Bureau pointed out, the main reason was that the structure of the national economy was not rational enough, with an excessively rapid rate of industrial growth which exceeded the rate of growth in coal output. Moreover, the long-term policy of low prices has slowed reduction of excessive industrial and civilian energy consumption. Disorganized coal transport, sales, and marketing procedures also have intensified this contradiction.

To solve the coal shortage, the Sichuan Provincial Government has now seized upon a development focus which includes coal production and supplies as industrial slants. This coal work conference conscientiously studied relevant measures for 1989 deployments.

It was revealed that besides increasing output and exploiting potential at existing mines and competing to ship in more coal, preparations are now moving forward to develop several new mining regions. The Junlian "coal sea" has impressive industrial reserves and will become a powerful reserve strength for Sichuan's coal industry.

Inner Mongolia Coal, Power Coordinated

40100046b Beijing XINHUA in English 0651 GMT 25 Apr 89

[Text] Beijing, April 25 (XINHUA)—China has finally started to put into practice a long-discussed project for the coordinated management of the coal and power industries, with two large open-pit mines taking the lead.

According to today's PEOPLE'S DAILY, the Yiminghe and Yuanbaoshan open-pit mines in the Inner Mongolia Autonomous Region have been chosen to pioneer the system.

The report says the practice is a part of the Energy Resources Ministry's plan to encourage such management in a bid to raise the economic efficiency of the country's energy resources. The plan was approved by the State Council earlier this year.

In the past, coal and power were managed separately in China, causing a great deal of waste and pollution.

The Yiminghe and Yuanbaoshan mines, both newly developed, have rich coal resources. The mines and power plants are located close together and therefore provide good conditions for coal-power coordinated management, the paper says.

Big Field Found in Western Shaanxi

40130091 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 31 Mar 89 p 1

[Text] Following the discovery of the Shenfu and Binchang coal fields in Shaanxi Province, another large coal field covering an area of 4,510 square kilometers with verified reserves of 9.663 billion tons has been discovered in western Shaanxi Province; the area covers Long Xian and Qianyang, Fengxiang, and Yongshou counties. Six seams were initially verified, the thickest of which is 12 meters.

Two Views on China's Petroleum Industry

40130077a Hong Kong LIAOWANG [OUTLOOK WEEKLY] in Chinese No 11, 13 Mar 89 pp 14-15

[Article by Li Yongzeng [2621 3057 1073]]

[Text] The year 1988 has just ended, and two groups of figures which are hard to comprehend have appeared on the books of the China Petroleum and Natural Gas Corporation. First, state plans were completed for both petroleum and natural gas production in China. Crude oil output was 137.02 million tons, up 29 million tons or 2.16 percent over 1987. Natural gas output was 13.9 billion m^3, up 400 million m^3 or 2.78 percent over 1987. Second, China's petroleum industry had industry-wide losses of about 1.4 billion yuan in 1988.

How can this be explained?

I. Eight Years of Contractual Responsibility, Output Steady at 100 Million Tons

China's petroleum industry has made substantial contributions to our national economic development. Petroleum output in China rose from 120,000 tons in 1949 to 137 million tons in 1988. This was an average yearly growth rate of 2.42 million tons over a 40-year period, and it changed China from an "oil-poor nation" to the world's fifth biggest petroleum producer. An intensified degree of extraction at several key oil fields and the effects of the laws of natural exhaustion have reduced China's crude oil output since 1980. This has attracted considerable attention in China and foreign countries and many people are worried about China's ability to maintain crude oil output at the 100 million ton/year level and whether or not it can continue to grow.

To control the momentum of declining petroleum output, we must intensify petroleum exploration, increase proven reserves, strengthen measures for stable output, and so on. This will require much more investments and work. Moreover, China is in a period of readjustment in the national economy and cannot bear the burden of such enormous financial outlays. It was against this background that the Chinese Government implemented a policy of contractual responsibility for 100 million tons of crude oil output in the petroleum industry in 1981. The petroleum industry is the first to have industry-wide contractual responsibility on a national scale.

Implementation of full contractual responsibility for output has led to vigorous growth in China's petroleum industry. During 8 years of contractual responsibility, the entire industry raised exploration and development funds totaling 29.9 billion yuan. Calculations using 1987 investment standards show that this sum of money could build 46 million tons in crude oil output capacity, equal to almost half of the newly added crude oil production capacity over this 8-year period. A reinforced self-development capacity led the government to reduce substantially the proportion of its investments in the petroleum industry. A total of 5.42 billion yuan was invested in 1981, and state investments comprised 44.8 percent. A total of 18.38 billion yuan was invested in 1987, and state investments comprised 18 percent. Total investments for 1988 were 21.42 billion yuan, with state investments accounting for 16.8 percent. China's petroleum industry has begun to form a stable development situation in which over-quota crude oil production results in additional capital being raised for exploration, and in which completion of more prospecting and development work leads to more rapid technical progress and greater newly added proven reserves and output of petroleum and natural gas.

After 8 years of contractual responsibility and through the joint efforts of 1.2 million petroleum workers, China's yearly crude oil output has stabilized at the 100 million ton level and is growing steadily each year. During the first 3 years of the Seventh 5-Year Plan alone, output in 1986 grew by 5.79 million tons from 1985, 3.45 million tons in 1987, and 2.9 million tons in 1988, basically achieving the plan to increase yearly crude oil output by 3 million tons.

Despite this, China's petroleum industry is far from capable of satisfying demand for growth of the national economy. China's GNP will quadruple by the end of this century, but annual petroleum output can only double, so the contradiction between supply and demand will be extremely serious. However, it will be extremely hard to maintain this rate of growth since there are no large replacement oil fields. According to the experts, the amount of oil which can be produced under given extraction techniques is a constant, and this constant can only be changed by changing extraction techniques. Given concrete circumstances at China's oil fields, extraction and recovery levels have not been low. This is due mainly to development of water injection and steam injection for heavy oil and highly congealed oil. Oil fields also have had problems with natural exhaustion laws. If we calculate on the basis of annual crude oil output of 137 million tons, the natural exhaustion rate has been held at 15 percent, a nearly 21 million ton decrease in petroleum output each year. Compensation for these losses requires drilling the equivalent of an additional 130,000 wells.

The 2.9 million ton net increase in crude oil output in 1988 did reduce this somewhat, but it was not easy. In the spring of 1988, several blizzards in northwest and northeast China caused a wide-area shutdown of oil wells. There also was major flooding at Daqing Oil Field in July and August 1988 which inundated over 1,900 oil and water wells in the field and reduced crude oil output by over 500,000 tons. In the winter, Xinjiang's oil fields were hit with alternating windstorms and cold currents and forced to shut off power and stop production. To ensure completion of state plans, petroleum workers expended an enormous effort and, instead of reduced output at Daqing Oil Field, they actually exceeded output quotas by over 300,000 tons.

II. False Losses and True Profits: 1.4 Billion Yuan?

The petroleum industry, which has been a major provider of taxes and profits to the state and a big generator of foreign exchange, has held to the overall index of 100 million tons of yearly crude oil output for the past 8 years of contractual responsibility and has increased output at a 2 percent yearly rate, but it has become a major loser. For 1 year, 1.2 million people worked for nothing and instead lost an average of 1,167 yuan/person. People in the petroleum industry are somewhat perturbed by this 1.4 billion yuan loss.

The industry-wide loss in China's petroleum industry was caused by a serious discrepancy between the price of crude oil and its value. Authoritative departments indicate that the cost of extracting 1 ton of crude oil now exceeds 94 yuan which, with an additional 26-plus yuan tax, means that the petroleum industry must spend over 120 yuan for each ton of oil it supplies, whereas the current price of crude oil is 110 yuan/ton, so they lose over 10 yuan for each ton of crude oil they sell. This is the crux of the problem.

Undeniably, there are many leakages in China's petroleum industry in areas that include internal management and administration, raw materials consumption, expenses and outlays, and others, so there is great potential for reducing costs. Labor productivity also is rather low compared to international levels. When crude oil output in the United States and the Soviet Union reached 100 million tons, for example, the average amount of oil produced per worker was, respectively, 576.2 tons and 1,132.4 tons. When China surpassed 100 million tons in crude oil output, however, this figure was just 105.8 tons. The international market price of crude oil after the slump, however, is now about $15 per barrel, equivalent to about 450 yuan/ton in renminbi terms, so our domestic market price is just one-fourth of the international market price.

It must be acknowledged that China's economic development has benefited from cheap petroleum and all processing industries have profited from cheap oil. People in the petroleum industry have figured several accounts:

In terms of direct benefits, calculating on the basis of the rather low international crude oil price of $105 per ton, China produced a total of 137 million tons of crude oil in 1988, and if we convert natural gas output and include it, the value exceeds $15 billion. Calculated for 1.2 million petroleum employees, each worker earned an average of $13,000 in foreign exchange per year.

In terms of secondary benefits, if we add up all income from selling oil to the petrochemical industry, commerce, foreign trade, and so on, total profits earned annually are about 33.5 billion yuan.

Regarding export foreign exchange earnings, China exported about 300 million tons of crude oil between 1981 and 1987 and earned $45.67 billion. This included foreign exchange earnings of nearly $7 billion during 1985, the year of the highest oil prices on international markets, equal to over one-fourth of China's total exports. In 1987, the year when oil prices were lowest, foreign exchange earnings from petroleum were only $1 billion-plus.

From the perspective of input/output ratios, the state invested a total of 18.7 billion yuan in the petroleum industry during 8 years of contractual responsibility. The petroleum industry turned over 56.3 billion yuan during the same period, equal to 301 percent of the total invested.

Thus, is it losing or profitable? We should examine how accounts are computed. In the present situation in which major readjustment in the price of oil is impossible, this additional debt must be borne by the petroleum industry.

III. Up in the West, Down in the East: A Way Out for Petroleum

The industry-wide loss suffered by China's petroleum industry has awakened us. In the initial stages of reform and opening up, energy resources and communications were included among key strategic industries for preferential development. To find the petroleum industry, a key one, in such embarrassing straits after 10 years is really worrying.

The goal for our petroleum industry in 1989 is still to raise output by 3 million tons to ensure that crude oil output reaches 140 million tons. China Petroleum and Natural Gas Corporation director Wang Tao [3769 3447] acknowledges that China's petroleum industry faces three big problems in achieving this goal:

First, there is the capital shortage. There is a substantial shortfall in the amount of capital that can be raised in a year relative to the input needed to produce 140 million tons of output annually.

Second, there are problems with resource replacement. Looking at present conditions, the amount of proven reserves at the end of 1988 available to build new production capacity was only enough for 1 year-plus.

Third, already developed old oil fields, especially our primary oil fields which produce over 60 percent of China's crude oil output, have entered or are about to enter the final stages of stable production, so stable production will become increasingly difficult.

Wang Tao said that dealing with factors which restrict investments in the petroleum industry depends on readjustment of state industrial policies and exploitation of potential in the petroleum industry. The other two

restrictions await accelerated exploration and development and advances in science and technology. Geological petroleum reserves proven in the past 10 years are equivalent to the total over the previous 30 years. This is particularly true of exploration in new regions. Breakthrough progress has been made in extremely shallow sea zones in east China's Bohai Bay and in Tarim Basin in the Xinjiang Uygur Autonomous Region in west China, and there is a great possibility that large or even especially large oil fields may be developed which could push China's petroleum industry up onto a new stage.

The seas of east China and the deserts of west China would seem to be two breakthrough points for growth in China's petroleum industry. The most recent evaluations indicate that only a very small portion of the total resources of 78.75 billion tons of crude oil and 33.3 trillion m^3 of natural gas on the Chinese continent and offshore continental shelf have been proven.

Policies Presented To Rapidly Promote Natural Gas Industry

40130072 Chengdu TIANRANQI GONGYE [NATURAL GAS INDUSTRY] in Chinese
No 1, 25 Jan 89 pp 66-71

[Article by Xie Yinghan [6200 5391 3211] of Zhongyuan Petroleum Prospecting Bureau, Zeng Shitian [2582 2514 3944] of Sichuan Petroleum Management Bureau, and Li Shilun [2621 1102 0243] of Southwest Petroleum College: "Some Ideas for Rapidly Developing China's Natural Gas Industry"; received 22 February 1988]

[Text] Based on the actual situation of the natural gas industry in China, the authors present eight policies urgently needed in the immediate development of China's natural gas industry and four tasks that require strengthening. The ideas are presented as references in policy-making.

Since the revolution, China has made considerable progress in developing its oil and gas industry. The 1988 annual oil output, some 1,500 times of that just after the revolution, has put China among the major oil producers of the world. The 1986 annual natural gas output was 1,400 times of that right after the revolution, but is still a long way off from the major producing countries of natural gas in the world. The differences are mainly in the "four lows and one waste." That is, the status of natural gas is rather low in China's consumption structure of primary energy, verified reserves and annual output are low and the growth is slow, oil and gas reserve-to-output ratio is low, investment ratio is low, and the waste of natural gas is high—strikingly high in some places.

Although China falls behind considerably, there are many favorable conditions as well. First, the government is paying great attention to the development in the natural gas industry, the natural gas reserve is rich, there is a huge area for prospecting, there is a sound basis in material and technology, and some measures have already been taken to speed up the natural gas development. Faced with this situation, the authors would like to make the following recommendations for the responsible departments to consider.

The "Heavy on Oil, Light on Gas" Attitude Must Change

For a long period of time, natural gas was considered in people's mind to be a by-product of the oil industry. The lack of attention on natural gas prevented its rapid growth and natural gas remained disproportionally small with respect to the 100 million ton plus oil production in China. Generally a major producer of oil is also a major producer of gas. The 1985 statistics showed that oil and gas production ratio in the world was 1:0.62, in the United States it was 1:1.02, in the Soviet Union it was 1:1, and in China it was 1:0.1. In order to change the preferential emphasis on oil, we have the following recommendations for surveying:

1. Recognize the Enormous Economic Value of Natural Gas

Natural gas is an important energy source and a precious chemical raw material, enormous economic and social benefits may be derived from it. Take Sichuan for example, natural gas accounts for about 15 percent of the province's primary energy sources. Roughly, 100 million cubic meters of natural gas can affect 200 million yuan of Sichuan's industrial value of production. The economic benefits of natural gas not only show up in production but also in investment. It has better overall benefits than oil in terms of prospecting and development. The recovery rate of natural gas is far greater than that of oil but the total capital construction costs for gas are less than that for oil. The social benefits of gas are also great because it has many uses, low cost, high heat content, low pollution, and convenient to use.

2. Natural Gas Wells Should Be Prospected Separately

Due to the differences in physical and chemical properties of oil and gas, their prospecting and development methods also differ. The differences are in the cause of formation, transport, storage, drilling, development, purification, sales and integrated utilization. Gas wells should generally be prospected separately.

3. Requirements of Oil/Gas Wells

Some of the oil/gas wells were used to produce oil only. They should be developed to produce gas and sufficient attention should be placed on the property differences between oil and gas so that these wells can produce both.

Eight Urgently Needed Policies

Policies are the key to the development of China's gas industry. It can be said that in the current situation everything is ready except policies. The Soviet Union

adopted a policy of giving natural gas priority and achieved great increases in gas reserve and production; resulted in being the world's largest producer of natural gas in 1985. Based on the condition of China's natural gas industry, the authors believe that there are eight urgently needed policies:

1. New Regulations Are Needed in the Estimation of Oil and Gas Reserves

In estimating oil and gas reserves, the amount of oil, natural gas (including associated gas), condensed oil and the useful constituents therein (ethane, butane, propane, sulfur and helium) should all the estimated and reported.

For the ground water in oil and gas fields, useful contents such as iodine, bromine, boron, manganese, potassium, uranium, cesium, germanium and strontium should be measured. Ground water with a high concentration of useful elements should be separated out in the oil and gas prospecting. Based on measurement results, a decision should be made on whether to recover these useful materials at the end of oil field prospecting or after the oil fields are developed.

Regulations of this sort could use the new regulations on oil and gas reserve estimation in the Soviet Union as a guide.

2. The State Should Make the Natural Gas Project a Separate Line Item and Implement the System of Separate Oil and Gas Prospecting

(1) The reserve, energy output and production of gas should be listed in the state plan. The state plan on natural gas should be officially handed down to the industry. Oil equivalent gas production should be allowed to substitute crude oil production.

(2) In China the importance of natural gas cannot be placed on the same footing as oil. One of the reasons is that state support of gas is not a separate line item, natural gas prospecting only receives a very low percentage of the support. In the Sixth 5-Year Plan, the total investment on natural gas development in China was only 6.3 percent of the total oil and gas prospecting investment.

3. Adhere to the Production Constant Contract System

In order to mobilize the initiative of the industry and accumulate the natural gas development foundation, natural gas, like oil, should also have a production constant contract system. The income due to above quota gas production should be used toward the gas development foundation and a certain portion of it should be set aside as benefit funds and awards. This policy has worked well in Sichuan.

4. Set a Reasonable Price for Natural Gas

The current price of natural gas in China is generally too low and inconsistent. When gas prices are compared with those of other energy sources on the basis of equal heat value, the natural gas price is lower than that of liquefied gas and is equivalent to 69 to 60 percent of coal gas in the city, or 24 to 16 percent of gasoline price, or 23 percent of the electricity price. The difference is even greater (only about 30 to 19 percent) when compared to natural gas prices in foreign countries. The price of natural gas in China is not only low but also single-priced, while in foreign countries the price is varied and flexible. There are domestic price and international price and the domestic price is further divided into well price and final customer price. The final customer price is divided into civilian price, commercial price, industrial price, and power price. Under the commercial price there are prices for production, price for coal black and others. The low price in China not only keeps profits low but also makes the recovery of investment very difficult. The well-site price in Sichuan is now 130 yuan per 1,000 m^3, and lower at other oil fields, hardly enough to cover the production costs. The 1980-1984 statistics showed that this item alone has produced a total loss of 440 million yuan, the general cost loss was even greater. A reasonable price for natural gas is therefore sorely needed.

We have the following recommendations for setting a reasonable price of natural gas:

(1) Set the price according to quality and cost; overcome the practice of single price.

(2) Reference the gas price to energy prices of equivalent effective heat value here and abroad so that the price determination is not only based on theory but also based on reality.

(3) Realistically consider the customers' ability to pay and provide state subsidy if necessary. This is in consideration of the difficulty in adjusting the prices of energy and raw material and the broad impact they have.

(4) Based on the above principles and the reality of the current economic reform, there should still be two well-site prices of natural gas: the commodity price (flat price) within the contract system and the above-quota negotiated price. Since the authors did not make in-depth investigations of the price, it is difficult to propose a soundly based reasonable price. As a reference and for further consideration, we believe that the well-site price of natural gas within target should be 200 to 250 yuan per 1,000 m^3 and the above-target well-site gas price should be 400 to 500 yuan per 1,000 m^3. Purification fee and piping transfer fee should be extra according to the circumstances.

5. Provide Tax Credits and Loans

The Seventh 5-Year Plan period will be a key period in China's natural gas industry. There will be growth in reserve, energy, and production, but there will be problems in capital. In order to assist and accelerate the development of the natural gas industry, we recommend that the state and the local government waive the taxes on natural gas and gas by-products and provide low interest loans. Imposition on gas prospecting and development units should be strictly prohibited so that the development fund for natural gas may grow. Although these practices will reduce the tax revenue of the central and local governments, but such tax loss will be far less than the social and economic benefits brought on by a developed natural gas industry. Based on Sichuan statistics, in 1984 the central and local governments collected a total of 32 million yuan of natural gas product tax and city maintenance and construction tax, in 1985 the figure was 43 million yuan, but in 1984 Sichuan used a total of 3.637 billion m^3 of natural gas, reaping a tax benefit of 1.912 billion yuan or 60 times the gas tax.

In the meantime, the profit and loss relationship of the gas production and processing industry should also be properly regulated through tax and other means so that the losses may be quickly turned into profits.

6. Management of Production, Supply, and Sales Should Be Unified

Gas producing areas in China are under the jurisdiction of the provinces. The fragmented state of production, supply and sales not only causes confusion and difficulty in the production, transport, balance, distribution and management of natural gas, but also to a large degree limited the improvements of industrial economic benefits because the gas producing enterprises cannot deal with the customers. In order to change this situation, the State Planning Commission has again announced that the right of distributing natural gas will be centralized in the State Planning Commission and the unified management of production, supply and sales must be adhered to.

7. Technical Policies Should Be Established for the Utilization of Associated Gas in Oil Fields With High Oil-Gas Ratio

We recommend that:

(1) When a new field (especially a high oil-gas ratio field) is developed, the construction period for facilities to process and utilize the associated gas should be shortened as much as possible.

(2) Oil fields with an average original oil-gas ratio greater than 1,000 m^3/t should be developed as a gas field and oil wells with such an oil-gas ratio should be developed as a gas well.

(3) Oil wells with an oil-gas ratio greater than 500 m^3/t should be controlled by a corresponding policy.

8. Laws Should Be Passed To Regulate Natural Gas

Like the railroad, telecommunication and electric power industries, the natural gas industry should also be regulated by law in order to halt the stealing of gas and to severely punish acts that harm the prospecting and development of natural gas. Such laws will ensure safe production of gas and protect the state's property. Therefore, natural gas prospecting and development regulations, contract regulations for gas production and natural gas management regulations should be established immediately.

Four Immediate Tasks

1. Strengthen the Integrated Utilization of Natural Gas

Further processing of the natural gas will have an important effect on the chemical industry and on the economic benefits of integrated utilization of natural gas in China. The various oil fields have devoted great efforts in gas processing; for example, based on the hydrogen sulfide and helium content of natural gas in Sichuan, the Sichuan Petroleum Bureau built a purification plant that produced 80,000 tons of sulfur per year and a chemical plant that produced 50,000 m^3 per year. At Zhongyuan oil field, efforts were made to recover light hydrocarbons; at Daqing, Shengli, Liaohe, Huabei, and Dakong oil fields, in addition to light hydrocarbon recovery, natural gas was also used in electric power production to increase the value of natural gas.

Although a lot has been done, there are still great potentials in the integrated utilization of natural gas. And there are a number of problems too. The problems are the lack of systemization of the collecting and transport facilities and the resulting high level of loss; in many oil fields the utilization rate is less than 50 percent. Light hydrocarbon recovery facilities have not been systemized and the import of new technology is very slow. Projects that use natural gas as raw material are also progressing very slowly and the integrated utilization of natural gas was directly affected. To improve the situation, the following tasks are of high priority:

(1) Make an organized effort to improve the systemized ability for light hydrocarbon recovery.

(2) Reduce oil-gas loss and pay attention to the use of small oil fields and dispersed gas.

(3) Develop the market for gas by-products and raise the level of activity in the gas industry.

(4) Make a major effort in developing the natural gas chemical industry and raise the proportion of gas as a raw material.

(5) Make intellectual investments, improve the quality of light hydrocarbon recovery operators, technical staff, and management personnel, and strengthen the scientific research and design capability.

2. Strengthen General Research and Promote Natural Gas Industrial Technology

Although each oil field has a certain amount of research in oil prospecting, development and processing, the efforts are at a fairly low level and the quality and quantity of research are inadequate. As to the general research in natural gas, the problems are even more serious. Since the general research in natural gas is the basis for the development of the gas industry, it particularly needs strengthening. We have the following recommendations in this area:

(1) Geological survey: Based on the current gas fields, actively search for high yield rich reserve, study the formation, change, migration and aggregation of gas in the major basins, investigate the characteristics of fissure gas reserve and its exploration methods, spend a major effort on the formation of coal gas, and strive for major breakthroughs in geological surveys.

(2) Drilling: In drilling wells we should take an approach that has six components: drilling, earthquake study, geological study, well measurement, recording, and gas measurement. Drilling techniques should be centered on strata pressure prediction, based on discovering and protecting oil and gas strata, and form a whole series of systematic technologies. The techniques should include parameter optimization, usage of high quality grout and high efficiency drill heads. Research should be done for equilibrium drilling technique, solid control technique, gas well reinforce technique, coring technique, slant prevention straight drilling technique, strata measurement technique, and oriented well and well cluster techniques.

(3) Gas field and coagulation gas field: Strengthen theoretical studies of water-driven gas reserve, coagulation gas reserve, and high-pressure, low-permeability gas reserve. Adopt modern mining technology and become systematic. Establish and perfect development management research system, formulate effective technology policy, and sensibly develop the gas fields.

(4) Natural gas mining, transport and processing: Different methods should be used for different situations in order to improve the recovery rate in water-laden gas fields. Gradually increase the degree of automation and the accuracy of gas measurements. Work hard in light hydrocarbon recovery and integrated utilization, develop Chinese-made compressors, and develop gas processing facilities, gas transport meters and equipment, and high pressure vessels.

(5) Research institutes: Take the limited research force in natural gas and divide up the tasks so that each group has its particular strength and unique research features. We recommend the establishment of a national center for research, testing and information in Sichuan as soon as possible.

3. Strengthen Personnel Training and Establish an Education System Geared Toward Natural Gas Development

Today the shortage of technical personnel and the interrupted flow of technical people are the major problems in the development of natural gas. We recommend that:

(1) Change the Southwest Petroleum College and the Chongqing Petroleum College into a college for natural gas. First, add a natural gas specialty in prospecting and development and, where needed, also in oil drilling and storage. To do so requires personnel, money, and resources. Strong supports should be given to accomplish this.

(2) In existing colleges develop specialties in light hydrocarbon recovery, natural gas purification, and integrated utilization. Train personnel in natural gas utilization as quickly as possible.

(3) Establish technical training centers at various levels. Concentrate at the present time on establishing the high quality multi-leveled natural gas prospecting and development center sponsored by the Canadian Government. This center will not only train master level students but will also offer continued engineering education and special training classes.

(4) In the training of personnel in natural gas technology, the old base in Sichuan should be fully used. Lateral interactions should be strengthened to promote exchange and improve the quality of natural gas production and management.

4. Open Up Exchange and Cooperation With Foreign Countries and Raise the Technical Level of Natural Gas Industry as Quickly as Possible

On the basis of self-sufficiency, systematically import advanced foreign technologies and open up exchange and cooperation with foreign countries. These are important steps in improving the gas industry in China. We recommend that:

(1) In strengthening the prospecting ability, high parameter equipment for logging and well measurements should be imported to enhance the ability of discovering and protecting gas reserves.

(2) Since gas reserves are usually deeper than oil reserves and the drilling speed at great depths is slow, the drilling speed of deep wells and the ability to handle complex situations should be improved. We recommend that

China import or collaborate with foreign investors in the development of under well power tools, PDC drill heads, universal nozzle core and other key tools and equipment.

(3) In order to speed up the development of gas field and condensation gas fields, whole N_2 systems may be imported (including N_2 production, injection, and removal). Also imported may include deep refrigeration of gases, pressurizing equipment for gas transport in pipes, gas turbine electrical power generator, sampling of gas in condensation wells, test equipment at the drill and under well equipment.

(4) Cooperate with foreign partners in the research of prospecting and development. For example, balanced well drilling and control technology, and the development of water driven and condensation gas reserve.

(5) Send delegations with general or specific purposes to the Soviet Union, the United States or Canada for systematic learning or observation.

Although today's natural gas industry has reached a stage of parallel development with oil, it has not peaked. Based on the predictions of Dr C. Marchetin in the United States on the trend of primary energy sources, the peak in natural gas probably will arrive in 2010 and the peak is higher than the petroleum peak. This is happening in the world, and so will happen in China also. Of this, we are very confident.

Natural Gas Discovered Beneath Daqing Oil Field

40100044a Beijing XINHUA in English
0929 GMT 13 Apr 89

[Text] Beijing, 13 Apr (XINHUA)—Abundant natural gas deposits have been discovered beneath the 30-year-old Daqing oil field, according to the latest issue of the NORTHEAST CHINA ECONOMIC JOURNAL.

The newspaper quoted Gu Shixiang, project manager of deep-layer prospecting at the Daqing field, as saying that the reserves of natural gas beneath Daqing amount to 100 billion cubic meters.

Manager Gu said that in the past 30 years, geologists at the oil field had drilled 28 deep wells with the deepest reaching 4,790 meters. He added that drill cores showed that at least 100,000 billion cubic meters of natural gas had been formed in the eastern part of the field, had industrially exploitable reserves were usually one-thousandth of the gas formation.

Manager Gu also said there is still a lot of work to be done to exploit the natural gas because it is more than 2,000 or 3,000 meters underground.

New Oil Base Taking Shape in South

40100045b Beijing XINHUA in English
1404 GMT 22 Apr 89

[Summary] Beijing, 22 Apr (XINHUA)—A new oil industrial base is taking shape in the Bose Basin, in the Guangxi Zhuang Autonomous Region. It is the first of its kind south of the Yangtze River. Five small oil fields and 15 natural gas zones have been verified and eight oil wells have been drilled in the basin. Facilities have been built for oil production, transport, processing, and marketing, the latest issue of CHINA GEOLOGICAL JOURNAL reports. Last year, 51,000 tons of crude and 20,000 cubic meters of natural gas were produced; one field alone produced 35,000 tons. The Bose Basin was chosen for experimental oil prospecting in small and medium continental basins, which are common over an area of 1.84 million square kilometers in the 11 provinces of south China. Prospecting began in June 1986, and two high-yielding oil wells were drilled the following year.

Senior Engineer Du Quanyi said experience in the Bose Basin showed that the prospects for finding petroleum in other small and medium basins in south China are promising.

High-Yield Well Sunk in East China Sea

40100045a Beijing XINHUA in English
0730 GMT 20 Apr 89

[Text] Beijing, 20 Apr (XINHUA)—Chinese geologists have sunk another high-yield oil well in the East China Sea, the ECONOMIC DAILY reported today.

The well, about 440 km southeast of Shanghai, has an estimated daily output of 1,892 cu m of crude oil and 148.6 cu m of gas, according to the paper.

This is the sixth oil well sunk in the region. Three wells have already gone into operation.

Shengli Drills Record Number of Wells

40100044b Beijing XINHUA in English
1500 GMT 17 Apr 89

[Text] Jinan, 17 Apr (XINHUA)—The Shengli oil field in Shandong Province has completed the multiple drilling of 42 directional wells with an average depth of 2,929.1 meters, the largest group ever drilled in a Chinese city.

The group of wells, situated in Dongying city, Shandong Province, covers an oil-bearing area of 3.5 square kilometers. Because of the many surrounding buildings, it was difficult to drill the wells in the traditional way—straight down for each well.

The multiple drilling, a newly developed technology, allows several slanted wells to be drilled, fanning out from a central drillsite.

The Shengli oil field took full advantage of the new technology and drilled 42 directional slanted wells on a site 384 meters long and 110 meters wide.

The drilling of the wells, begun in January 1988, took 16 months and was completed 5 months ahead of schedule. It saved the country more than 30 million yuan (8.1 million U.S. dollars) and 23.6 hectares of farmland.

The oil wells will be able to produce 2.63 million bbl of crude oil annually after they are put into operation.

Production at Zhongyuan Oil Field To Be Accelerated
40100044c Beijing XINHUA in English
0812 GMT 18 Apr 89

[Text] Jinan, 18 Apr (XINHUA)—China will speed up the tapping of the Zhongyuan oil field, which covers a large expanse of central China's Henan and Shandong provinces.

The work will concentrate on new oil and natural gas deposits in Shandong. A committee in charge of the project has been organized with Zhang Ruifeng, vice-governor of Shandong Province, and Zhou Yongkang, deputy director of the China National Oil and Gas Corporation, as its heads.

The project is expected to add 7 million bbl of crude oil and 200 million cubic meters of natural gas to the field's annual output next year.

Trends in Nuclear Power Development in China Reviewed

40130080 Chengdu HE DONGLE GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 10 No 1, Feb 89 pp 1-3

[Article by Peng Shilu [1756 1102 4389], China Nuclear Industry Corporation, Beijing]

[Excerpts] [Passage omitted] The establishment of China's four modernizations requires a great deal of energy. The development of energy, in particular the development of electric power, has already become a major factor influencing China's economic progress. However, the development of hydropower in China is limited by location and season and thermal power is restricted by coal resources, the inadequate transport capacity of the railroads, and serious pollution of the environment. Therefore, development of nuclear power is the direction that China's energy construction will take. We must study the domestic and foreign situation in the development of nuclear power construction and learn lessons from experience, formulate China's nuclear power development program, and promote and accelerate the progress of China's nuclear power industry. [passage omitted]

2. Several Points of View on China's Development of Nuclear Power

1) Programs and Policies Regarding Nuclear Power Development

At the conference "Nuclear Energy in China During the Nineties" in Beijing from 10 to 13 October 1988, jointly convened by the State Council's Office of Nuclear Energy, the Ministry of Energy Resources, and the China Nuclear Industry Corporation, specialists proposed that China's electric power development policy should be to work hard on developing thermal power and strive to develop hydropower while gradually and vigorously developing nuclear power. If energy resource development is to be increased four-fold from 1991 to 2000, then by the year 2000 coal demand will reach 1.4 billion tons. The amount of this consumed by thermal power generation will reach 600 to 700 million tons and one-third will be used in the southeastern coastal and northeastern regions. If thermal power is to be developed in these regions the transportation of coal is seriously limited and water resources are lacking for the development of hydropower. Therefore, first, the power structure must undergo appropriate alterations. In those regions lacking water and coal, nuclear power must be gradually established to meet part of the requirement. At the conference a concept for a nuclear power development program was proposed. What this concept envisages is the beginning of work on the construction of 4,000 to 5,000 MW between 1991 and 1995 with entry into operation before the year 2000. By that time China will have nuclear power plants totaling 6,000 to 7,000 MW in operation. From 1996 to 2000 plans are to begin construction work on 6,000 MW, allowing nuclear power units totaling 1,200 MW to enter operation each year after the year 2000. By 2015 it may be hoped that China's nuclear power will have become a major pillar of the energy industry.

With regard to China's need to develop nuclear power and the development program, the relevant departments have already done a great deal of confirmation and study. For electric power on a national scale in the future, thermal power will still occupy the dominant position. However, due to the influence of two factors, i.e., coal transportation difficulties and environmental pollution, the progress of China's nuclear power must be promoted. But, initial investment in the development of nuclear power is great, the construction period is long and returns are relatively slow in coming. For this reason, there exists a pervasive contradiction between need and feasibility. Need requires that the scale of nuclear power development be somewhat larger, while feasibility dictates that the scale of nuclear power cannot be large. The reasonable solution of this contradiction is an important problem. At present, apparently there are two policies. The low policy which leans more toward feasibility. This has somewhat more modest goals, with 4,500 MW definitely being attainable. The high policy proceeds more on the basis of need, with objectives possibly somewhat higher, e.g., 6,500 MW, which would require a struggle.

2) The Technological Route and Technological Policy for Development of Nuclear Power in China

Our technological route should be: "Cooperation with Foreign Countries Centered on Ourselves." The 600 MW PWR nuclear power unit should be vigorously developed to achieve a uniform standard and realize standardized, domesticated batch production, becoming within the next 10 or 20 years, the focus of China's primary efforts in nuclear power. In light of the present situation in China's ability to manufacture equipment and considering the factors of the feasibility of China raising the investment [capital] for nuclear power plants as well as construction, operational and managerial competence, the ease of establishing a domestic foundation and gradually achieving independent design and batch production within a fixed period of time, China's emphasis on development of the 600 MW unit is appropriate. If a 1,300 MW unit is to be developed a one reactor two unit scheme can also be adopted to achieve this.

The Qinshan 300 MW unit has passed through prototype reactor construction and experience is being accumulated, and the formation of an equipment manufacturing system has been begun.

Advanced PWR's such as the APWR, AP-600, PIUS and the high temperature gas cooled reactor, or HTR, constitute a new generation of nuclear power plants which possess very good intrinsic safety. We should participate

in international cooperation and joint development to facilitate the pursuit and mastery of internationally advanced technology for our own use.

3) Sources of Funding and Investment Control

Because nuclear power has the characteristics of being technology intensive, of demanding high safety requirements, of a long construction period and of slow returns, under China's present economic conditions it is difficult for the state to allocate a large amount of investment, and the management of independent investment is even more difficult. Therefore, three routes, i.e., fund raising by the central government, by localities and by the nuclear industry itself must be taken to a solution. Adoption of unified handling of nuclear power by which one party manages while many parties invest is an important method of promoting and accelerating the development of nuclear power. This route was taken with the two 600 MW units of the second stage of construction at the Qinshan nuclear power plant. Funds were raised by six companies, and eight organizations formed a joint corporate board of directors. The board of directors is the owner of the nuclear power plant. Under the direction of the supervising department, i.e., the Nuclear Industry Corporation, it takes overall responsibility for the raising of investment, project construction, management, assurance of safety and loan repayment. [passage omitted]

Accelerating the Development of Nuclear Power

40130077b Hong Kong LIAOWANG [OUTLOOK WEEKLY] in Chinese No 11, 13 Mar 89 pp 16-17

[Article by Fu Pingping [1381 5493 5493]: "Optimize the Energy Resource Structure, Accelerate Development of Nuclear Power"]

[Text] Sluggish electric power construction is now considered to be a major "trap" for China's future economic development. How can this trap be "opened"? The view of experts is that adoption of slanted policies to increase investments in electric power are of course important, and that from the long-term development perspective, we should readjust the direction of investments and optimize our energy resource structure. Accelerated nuclear power construction should be one part of optimizing our energy resource structure.

I. Limitations of Our Existing Energy Resource Structure

Petroleum, coal, and hydropower are China's three main conventional primary energy resources and together they form China's fundamental energy resource structure.

China's petroleum industry has grown very quickly in the past few years, with output reaching 137 million tons in 1988. The discovery of large oil pools in west China and a shift from exploration to combined exploration and development of offshore petroleum have revealed rather good development prospects. Nevertheless, it will be rather hard to increase crude oil output substantially in the short term. Moreover, if crude oil output were to increase substantially, the state would want to accumulate capital by exporting part of it to earn foreign exchange or provide it to the chemical industry as a raw material for intensive processing. Thus, for a considerable time to come, petroleum cannot occupy a primary status in China's energy resource consumption.

China is the world leader in hydropower resources. Survey statistics show that China has theoretical hydropower reserves of 676 million kW and a developable hydropower capacity of 358 million kW, but only about 5 percent has been developed to date. Thus, there is great potential for development, particularly given the growing shortage of non-renewable energy resources, which makes development of hydropower even more significant. However, flow rates on China's rivers are unstable, with enormous yearly and seasonal differentials in flow rates. Thus, if we wish to allow hydropower stations we build to play their roles fully we still must build several thermal power plants for regulation.

China is one of the few nations where coal continues to be the primary energy resource since oil came to dominate world energy consumption. Coal has accounted for over 70 percent of China's energy resource production and consumption for a long time. China has abundant coal resources. If we extract them at a yearly rate of 1.4 billion tons/year (calculated on the basis of indices for quadrupling the gross value of industrial and agricultural output) until the end of this century, extraction can continue for 200 to 300 years. Moreover, since development of coal requires fewer investments and produces results quickly, coal will continue to account for over 70 percent of China's energy resource production and consumption for a long time. However, like hydropower, China's coal resources are very unevenly distributed. If we use the Beijing-Guangzhou Railroad as an east-west dividing line, proven reserves and projected reserves in east China account for just 15 percent, while 85 percent is to the west. If we use Qinling-Dabie Shan as a north-south dividing line, the north has 94 percent and the south just 6 percent. This configuration causes major "traveling" of China's coal. Statistics show that coal shipments comprise about 40 percent of China's total railway freight volume, which makes it even harder to satisfy demand. It is apparent that coal construction in China will be substantially restricted by shipping capacity. Moreover, environmental pollution from coal-fired power is arousing growing concern.

II. Nuclear Power: An Inevitable Trend in Future Development

Thus, people have looked toward another energy resource besides the three conventional energy resources—nuclear power.

Minister Huang Yicheng [7806 3015 6134] of the Ministry of Energy Resources has said that "looking to the beginning of the 21st century, China must develop nuclear power. If China's coastal developed regions do not develop nuclear power by that time and rely completely on coal-fired power to satisfy demand, there will be a major problem with transportation as well as severe pollution of the atmosphere and environment."

Indications are that nuclear power has grown extremely quickly after it appeared. Since the world's first nuclear power plant went into operation in the Soviet Union in 1954, over 400 nuclear power generators have gone into operation worldwide with a total installed generating capacity in excess of 300 million kW, and they produce about 15 percent of total world power output. Nuclear power accounts for more than 50 percent of total power generation in some countries.

Nuclear power has many advantages. First, nuclear power is not as expensive as everyone thinks. Experiences in foreign countries have shown that although capital construction costs for nuclear power plants are higher than thermal power plants, the fuel costs of nuclear power plants are much lower than thermal power plants and the operating costs of both are about the same. Thus, if we convert power generation costs per kWh, nuclear power is cheaper than coal-fired power. The cost of nuclear power in India is one-half to one-fourth lower than coal-fired power.

Second, the shipping volume for nuclear fuels is miniscule compared to coal. A 1 million kW pressurized-water reactor nuclear power plant requires just 30 tons of nuclear fuel each year, whereas the fuel needed by a coal-fired power plant of equivalent scale requires shipment by a 10,000-ton freighter or three 40-car trains for transport every day.

Third, risks at nuclear power plants are comparable to risks in all types of industry and social risks, and are very small. Thousands of workers are killed in China's coal mines each year, whereas the two serious accidents which have occurred in the history of nuclear power, the reactor meltdown accident at the Three Mile Island pressurized-water reactor nuclear power plant in the United States on 28 March 1979 and the reactor accident at the No 4 reactor at the Chernobyl Nuclear Power Plant in the Soviet Union on 26 April 1986 killed no one in the first case and just 32 in the second.

As for everyone's concern about environmental effects of nuclear power, experience has confirmed that control according to specified regulations can make it insignificant.

Because nuclear power has these advantages, it will continue to be an important part of energy resource supplies in the industrialized nations. Nuclear power in nations in the Organization for Economic Cooperation and Development will increase to one-fourth of their total power output by the year 2000. Nuclear power will provide 75 percent of all power generated in France in 1990. Despite the accident at the Chernobyl Power Plant in the Soviet Union, it has not reduced plans to develop nuclear power, and nuclear power as a proportion of all power generated will double in 1990. Most developing nations also have formulated plans to develop nuclear power. Statistics show that nuclear power in the developing nations will grow at an average annual rate of 8.4 percent between 1986 and 2000. The utilization of nuclear power to generate electricity is a major trend in the development of electric power in the world at the present time.

III. Nuclear Power Construction Has Begun in Mainland China

Nuclear power construction has begun in mainland China. Guangdong's joint Chinese-foreign 1.8 million kW Daya Bay Nuclear Power Plant construction project is now proceeding as planned. The 300,000 kW Qinshan Nuclear Power Plant designed and built by China itself has entered the full installation stage. Authoritative sources have revealed that China's goal for nuclear power development up to the end of this century is to complete 6 million in nuclear power generators with annual power generation of 30 billion kWh.

Still, nuclear power development faces problems like long schedules, large investments, involvement of a wide range of industries, and so on.

Huang Yicheng has stated that the capital needed for nuclear power development can come from the approximately 1 billion yuan renminbi received in exchange for oil produced in excess of quotas for the state each year by the China Petroleum Corporation, and the insufficient portion can be raised by local areas. Foreign investments also can be utilized.

Dai Chuanceng [2071 0265 2582], well-known director of the Chinese Academy of Atomic Energy Sciences, said: "State financial limitations are a fact, but there also is a question of selecting the direction of investments for this limited capital." He calculated that China plans to add an average of 9 million kW in generating capacity each year over the next 5 years, including 7 million kW in coal-fired power. Providing the fuel for 7 million kW would take up two-thirds of newly added raw coal each year and one-half of newly added railway transport capacity. This means that the cost of capital construction for nuclear power would be roughly equivalent to that of coal-fired power. Thus, he feels that overall accounts must be calculated regarding this matter without further delay.

Qinshan 300 MW Generator Passes Tests

40100045c Beijing XINHUA in English 0601 GMT 23 Apr 89

[Text] Shanghai, 23 Apr (XINHUA)—The steam generator for the 300,000-kilowatt Qinshan Nuclear Power Plant in Zhejiang Province has been checked and passed as fit for use by a panel of scientists here last Friday, a scientist of the panel told XINHUA today.

The equipment will be sent to the construction site for installation, the scientist said.

The steam generator is one of the key pieces of equipment for the nuclear power station. The safety and service life of a nuclear power station is directly related to the quality and service life of its steam generator.

Most of nuclear power plant accidents in the world are caused by leakages from the steam generator, according to the scientist of the panel.

The steam generator was designed by the Shanghai Nuclear Engineering Research and Design Institute and built by the Shanghai Boiler Factory. It is 18 meters long, has a diameter of 4.2 meters and weighs 208 tons.

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